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ESSAYS, ABSTRACTS AND REVIEWS

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ESSAYS, ABSTRACTS and REVIEWS

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Original Articles.

THE NEWER OPERATIONS FOR GLAUCOMA*

L. Webster Fox, M. D., LL. D.

PHILADELPHIA, PA.

We all remember the time when we placed the greatest confidence in iridectomy as a panacea for most forms of glaucoma. Introduced by Von Graefe in the middle of the last century, it carried with it for many years the prestige of his great name and clinical experience.

If iridectomy were not successful in relieving or retarding glaucoma, it was the custom to consider the case as one of a malignant character, or it was supposed that there had been some mysterious fault in the technique and execution of the operation.

In course of time when a large number of pathological specimens of cases operated on had been examined it was evident that those which had retained permanent drainage from the anterior chamber through a cystoid cicatrix were the most successfully and permanently relieved, and towards the close of the 19th century it was realized and boldly asserted that iridectomy was not curative in all cases, and that some new method of operating for glaucoma which insured filtration from the anterior chamber must be sought for.

In 1901 De Wecker made his report upon the subject to the French Ophthalmological Society, and Parinaud in a discussion on that report stated that he had endeavored to make filtration cicatrices by leaving the iris incarcerated in the wound. From 1901 until the present time several new operations with various modifications have been introduced with a view to procure permanent drainage of the aqueous in glaucomatous eyes. In 1903 Major Herbert, an English military surgeon, practising in the East Indies, published the results of an operation on 130 cases of glaucoma by

*A lecture delivered August 2, 1912, Medical Department, University of Colorado. "Summer Work in Ophthalmology."

intentionally leaving the prolapsed iris in the scleral wound, but he was conscious of a possible danger in making a hernia of the iris and sought to introduce a fold of conjunctival flap.

Herbert afterwards introduced a wedge isolation operation—a modified sclerectomy, for the relief of glaucoma, and in his own practice and that of Priestley Smith the results are said to have been most satisfactory and the failures but few. The earlier operation of Herbert was performed with a very narrow, tapering Von Graefe knife, but two knives are now commonly used in place of the Von Graefe knife; a keratome for the primary incision and a short, blunt, pointed, narrow blade for the lateral cuts. Major Herbert performed his earlier operations with a very narrow V. Graefe knife, either in the lower outer or upper outer quadrant of the eye. The knife was made to penetrate the conjunctiva 2.5 mm. from the point at which it was intended to perforate the sclerotic. After sliding the conjunctiva on the point of the knife a 2 mm. scleral incision was made parallel with the corneal circumference and 1.5 mm. from it, entering the anterior chamber close to its angle. At the two ends of the small section the edge of the knife was turned forwards and incisions made with slow sawing movements to the corneal margin. These two incisions formed the sides of the small flap, the primary incision the end of the flap, and the whole was subconjunctival. Considerable conjunctival edema resulted from the immediate outflow of the aqueous.

The keratome, which is really a bent, broad needle not wider than 3.5 mm., is now used for the primary incision and a short, blunt pointed narrow blade for the lateral cuts. By using a bent instrument it is possible to make the incision upwards or downwards. Before the operation the pupil is contracted as far as possible by eserine and usually one or more instillations of adrenalin are made in addition to cocaine, according to the degree of glaucomatous congestion of the eye.

Priestley Smith is of the opinion that the later modifications in the Herbert operation have not made the results more certain.

For the purpose of facilitating the making of the lateral incisions, M. Bishop Harman has introduced his twin scissors. The lower or male blade is flat and beveled so that each side represents a sharp edge. Its free end is rounded and blunt, and projects 2 mm. beyond the female blades. The upper or female blades are a pair of parallel, sharply beveled blades springing from a common stump. When the handles of the scissors are closed the female

blades shear down on the side of the male blade, and come to rest in overlapping it.

In operating with this instrument Harman has found it convenient first to turn forward a flap of conjunctiva from the chosen site of the sclerotomy, then the keratome is inserted into the sclerotic 3 mm. from the clear corneal margin and passed through under the sclerotic until its point appears within the corneo-iridic angle; it is pushed on until a clear 3 mm. of the blade is within the anterior chamber. The keratome is then withdrawn. Now the male blade of the twin scissors is pushed along the track of the wound until the projecting 2 mm. of the blades show within the anterior chamber; the scissors are then closed—the cuts made—the male blade gently withdrawn and with a replacement of the conjunctival flap the operation is complete.

Heine in 1905 made known his operation of cyclo-dialysis, which is essentially a detachment of the ciliary body and effects a connection between the supra-choroidal space and the anterior chamber.

There exists a considerable amount of literature in reference to this operation, but it is evidently not without dangerous complications and its actual value has yet to be determined by experience. In 1906 Lagrange introduced his operation by which he endeavored to obtain a filtering cicatrix without including the iris in the lips of the wound. This he believes he has succeeded in doing by an operation combining iridectomy and sclerectomy. About half an hour before operation a few drops of eserine are instillated, and as the time for the operation approaches, cocaine and adrenalin are dropped into the eye several times to produce complete insensibility of the iris and obvious ischemia of the mucous membrane.

In addition to the instruments ordinarily used for iridectomy is needed a small pair of curved scissors, which should be very sharp.

In the first stage the sclera is punctured with a Von Graefe knife at a distance of 1 mm. from the limbus, and the counter puncture is made at the corresponding point. The sclera is divided upwards in the irido-corneal angle. In terminating the incision, the cutting edge of the blade is directed backward in such a way as to bevel the sclera. When the knife is beneath the conjunctiva a large conjunctival flap is made. In the second stage the conjunctival flap is raised by means of toothed forceps and a sufficiently large piece of the sclera is cut from the exterior lip of the incision. In the third stage iridectomy is performed in the usual way and finally the conjunctival flap is used to cover the wound.

The Lagrange operation has been performed extensively through-

out France and modifications of it have been made by Holth, Dor, Jacqueau and Coppez.

In many cases remarkable success has followed the operation and yet according to French writers there have been some regrettable failures.

Recently M. Abadie undertook to denounce sclerectomy, whilst he defended iridectomy in an unmistakable manner. He concluded his article by saying:

"Hold iridectomy as the operation of choice in glaucoma, and endeavor especially to make it as simple and correct as possible."

In reply M. Lagrange asserted that "the happy results from sclerectomy are infinitely more lasting and more numerous than by every other method."

Thus two great men in the profession have drawn directly opposite conclusions as to the relative value of two important operations. Time alone can work out the problem satisfactorily. Not only does Abadie defend iridectomy, but statistics of the later results of that operation have been forthcoming from Hallauer respecting 200 cases, from Irma Herezogh in reference to 310 patients, as well as from Von Grosz, de Koster and others.

Bettremieux of Robiax, France, has, since 1908, practised a simple sclerectomy which he describes as non-perforating. He snips away particles of the sclerotic for a width of 2 mm. and a length of 10 mm. outside of the limbus, but he does not consider it necessary to penetrate the sclerotic, as he is of the opinion that by his limited operation he establishes anastomoses between the deep vessels of the pericorneal region and the conjunctival and sub-conjunctival vessels.

Bettremieux has reported some remarkably good results from his operation and singular to tell he has performed his operation with success upon two cases of detachment of the retina in myopic subjects.

We now come to the consideration of the operation of simple trephining of the sclera for the relief of glaucoma, which is generally spoken of as the Elliot operation or the Fergus-Elliot operation.

Major R. H. Elliot, an English army surgeon practising in the East Indies, operated upon a large number of cases of glaucoma by trephining without being aware of similar work having been already attempted in Europe. His first trephining of the sclera for glaucoma was performed August 2nd, 1909, and it was reported in the Ophthalmoscope for December, 1909. Dr. Freeland Fergus of

Glasgow had performed a similar operation two months earlier, and it was reported in the British Medical Journal, Oct. 2, 1909.

The idea of drilling a hole in the coats of the eyeball for glaucoma was not a new one as Dr. Argyll Robertson (in the Royal London Ophthalmic Hospital Reports for May, 1876) recommended it when iridectomy could not be performed, and it has also been recommended by Blanco (Klinische Monatsblätter für Augenheilkunde XII, Band ii, p. 150, 1903) and by Frohlich (Ibid, May, 1904).

The preparatory treatment of a case of acute or sub-acute glaucoma consists in the administration of a free saline purge, the application of four leeches around the orbit, the instillation of eserine and an opium sleeping draught. The tension, congestion and pain are greatly relieved by the next day when the trephining operation is undertaken. In the majority of cases Major Elliot relies upon cocaine solution (4%) for anesthesia of the eyeball. The first step in the operation is the formation of a large triangular flap from above the cornea, the attached base being at the sclero-corneal margin. The dissection is continued for the distance of a millimetre into the substance of the corneal tissue in order that the entrance of the trephine into the chamber may be assured by being applied exactly over the limbus.

In all this dissection it is important to keep the points of the scissors directed towards the plane of the posterior pole of the lens; otherwise it is probable that a buttonhole will be made in the conjunctival flap. The spot selected for trephining should be as close to the limbus as possible, indeed the aperture becomes a sclero-corneal rather than a scleral opening. The trephine should be used with quick, light movements and care should be taken that its first application serves to bite into the sclera before it is raised—to see the progress made, and in his early cases the surgeon feels the need of frequently raising the trephine to see how he is progressing. But he will soon be able to recognize the points which indicate that he has penetrated the chamber.

(1) As soon as the chamber is tapped aqueous wells up along the side of the instrument and mingles in streaks with the surrounding blood; (2) there is a sucking sensation as soon as the trephine's work is done, and (3) the patient makes a slight, peculiar movement at that moment. Should the disc remain attached to one point of the sclera, it is easily separated by a cut with iridectomy scissors, but should the disc happen to fall into the chamber, it need not be a cause for anxiety.

Major Elliot prefers the trephine of Stephenson, made by Weiss

& Son, but a more perfect one is said to have been recently made by Arnold of London. Elliot prefers that the trephine should not exceed 2 mm. in diameter and has a decided fancy for one of 1.5 mm., which he considers, in the hands of an expert, may probably yield all the opening which may be needed.

Should the iris bulge into the aperture the moment the disc is cut through, it must be snipped in a radial direction in order that the aqueous may escape. The membrane often goes back of itself, but if it does not, a piece must be excised, care being taken to avoid traction on the iris.

In making the toilet of the wound, Major Elliot uses a McKeown irrigator with good results if there are any tags of iris in the wound or if the chamber fills with blood.

The closure of the wound is made by the flap without need of suturing.

As a rule Elliot avoids all instillations immediately after operation. On the third day he drops in a solution of atropin (gr. iv ℥i) to counteract the tendenecy to formation of posterior synechiae.

Major Elliot reported at the meeting of the British Medical Association held last year (July, 1911) that the operation he advocated had then been performed in 403 cases in Madras. In five per cent. of his cases there had been escape of vitreous—16 of them in desperately bad eyes where every risk was intensified. In nearly 50 per cent. of the cases iridectomy had been done conjointly with the trephining. In some cases this procedure had been followed because the iris tended to advance into the hole, but that was not always so. He approves of performing iridectomy in most cases if merely as a mechanical safeguard.

We will refer to sympathectomy only to speak of it as a discarded operation for glaucoma, notwithstanding that it has been so skilfully performed by Jaboulay, Abadie, and the great Jonnesco himself.

It is interesting to note that thoughtful writers upon the newer operations for glaucoma make repeated and emphatic reference to the value of equatorial or posterior sclerotomy, the first operation designed for relieving glaucoma. It was designed by Guerin, a surgeon of Lyon, who, in his "Treatise on the Diseases of the Eye," published in Lyon in 1769, expresses himself in the following terms:

"When the vitreous humour is in too great abundance, the pupil is dilated to its fullest extent and has almost lost its elasticity. Such patients complain of a deep, dull pain at the back of the eye,

which extends sometimes to the front of the head because the volume of the vitreous body compresses and dilates the retina, an expansion of the optic nerve. The sight is affected because the retina is injured."

After referring to medicinal remedies, Guerin adds:

"If all the remedies are without success, one comes to the puncture of the eye in the sclerotic or opaque cornea. That puncture ought to be simple and without much preparation and it can be executed by a rather broad cataract needle. The effort which is being unceasingly made by the over-dilated sclerotic to return to its natural state suffices for the expulsion, little by little, of the superfluous humour."

Guerin's operation was from time to time revived and we find it was performed by Woolhouse, and by Mackenzie, and more recently by De Wecker, Parinaud, Motais, and others. Whilst strongly advocating the use of posterior scleral puncture "as a preparatory operation in the acute forms not already operated upon, and as an operation of salvation to the eye in the post-operative acute forms," Dr. Louis Dor of Lyon states that he knows of cases where it was to be regretted that posterior sclerotomy had not been performed, but he does not know of any case where he regretted that he had performed it.

Priestley Smith also tells us that in his experience posterior scleral puncture preceding the operation for iridectomy is a most beneficial proceeding; it slackens the tension of the eye, lessens the risk of the sudden loss of tension at the moment of the larger incision into the globe, and in no wise increases the difficulty of iridectomy.

As regards the relative value of various operations for glaucoma it would appear that almost all ophthalmic surgeons are unanimous as to placing their reliance upon iridectomy as the curative operation for acute glaucoma.

Great success has undoubtedly followed the performance of the various newer operations for chronic glaucoma, but none of them has given me greater satisfaction than the Fergus-Elliot trephining of the sclera. As already stated, Major Elliott makes the base of his triangular flap at the sclero-corneal margin, but in several instances I have reversed this practice, and as in the Van Lint sliding flap operation for cataract, I seize with the forceps the conjunctiva on the inner side of the right cornea about 4 mm. below its summit and dissect it around the upper corneal margin to the outer side—then with scissors I detach the conjunctiva for 12 or 14 mm. up-

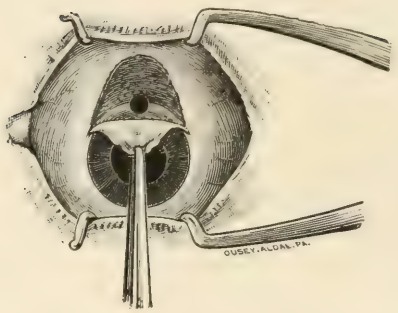

FIG. 1.—Fergus-Elliott conjunctival flap and cornea-scleral (trephine) opening.

wards. A suture is next inserted in the loosened conjunctiva at the lowest point of the inner side. From this point I make a perpendicular incision for 14 mm. through the conjunctiva, which is continued diagonally upwards and outwards to a similar distance.

When operating on the left eye I begin the dissection of the flap on the outer side of the cornea and make similar perpendicular and diagonal incisions upwards and inwards. When completed the flap is drawn over to its attached side on the eyeball, leaving a space for the trephining along the upper sclero-corneal margin.

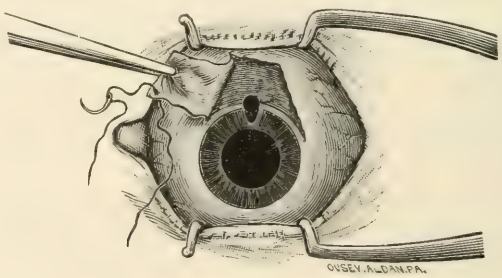

FIG. 2.—Author's modification of conjunctival flap.

After the trephining the conjunctival flap is replaced and by means of the suture already inserted, it is drawn downwards to cover the hole in the sclera and the upper part of the cornea.

From time to time I have modified the treatment of the conjunctival flap, at one time stitching it down on one side and removing the thread at the end of 24 hours; at another simply loosening the conjunctiva over the corneo-scleral opening and allowing it to heal—but the above described method has given me the most satisfaction.

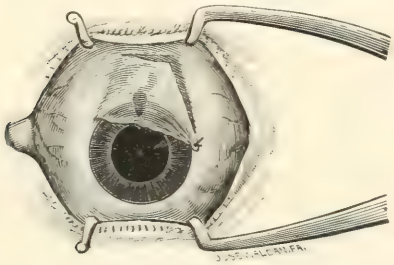

FIG. 3.—Conjunctival flap in position.

My first two cases were operated upon by this trephining method early in September last (1911), and since then I have repeated it about one hundred times and in no case with bad results. In all of these cases the intra-ocular pressure was minutely taken before and after the operation by Schiötz's tonometer. This instrument gives us a very accurate estimate of the tension of the eyeball. The blood pressure was also taken in each and every case, and was often found to be much above the normal. The highest was 290 Hg. In this case the tension of the eyeball was 88 mm., which was equivalent to +3 in the older nomenclature. If an iridectomy had been performed, in this case, retinal hemorrhage would have undoubtedly occured, and enucleation of the eyeball would have followed. In fact it would not have been good surgery to have tried any operation but enucleation. By performing this operation in other cases of a similar character we have at least retained the eyeball. In cases where the visual fields were very much contracted down to 10 and 15 degrees, I have found that this vision was not only retained, but in many cases it became increased. My earlier operations were made with the Stephenson trephine, but I have had the cutting parts with stops and of varied widths adapted to the Von Hippel trephining instrument, and have thereby secured greater ease in manipulating the trephine, and in regulating the depth and direction of the incision.

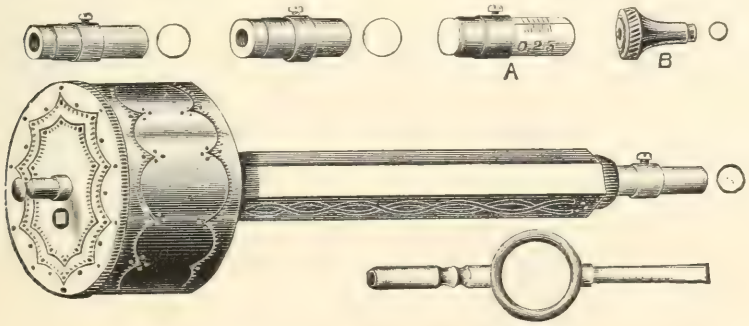

FIG. 4.—Von Hippel trephine

Since Von Graefe's benefaction to the world, thousands of eyes have been saved from blindness, which before his time would have been irretrievably lost, and since then giant strides have been made in the treatment of glaucoma. We are still going forward, hopefully and fearlessly pursuing the combat against that much dreaded disease, and ere long the tonometer, the ophthalmoscope and the perimeter may be supplemented by instruments and methods of investigation of such delicacy and precision that it will be possible to make an earlier and more accurate diagnosis of glaucoma than at present. It may be that with such advances some new drugs will be discovered which will surpass in efficacy the myotics and the other medicinal agents now at our command.

Looking to the operative side, the success already achieved by means of iridectomy and the newer operations for glaucoma makes us sanguine in the anticipation that the treatment of that formidable disease is being rapidly perfected. Scientists in every department and throughout the world are in these days fully alive with the spirit of research, and one by one the mysteries of nature and the complexities of disease are being unfolded to us. Surely the ophthalmologist cannot fail ultimately to find the light and reach the goal he seeks so earnestly.

UNILATERAL GLAUCOMA FROM CONGENITAL MALFORMATION

Dr. Louis Dor,

LYON, FRANCE.

Translated by L. Webster Fox, M. D., LL. D.

P., aged 40 years, came to consult me in the month of March, 1905, complaining of severe pains of the left eye. We immediately diagnosed his case as one of absolute glaucoma, but certain deformities of the face of the patient attracted our attention. Whilst the right side of the face presented a natural aspect, there existed longitudinal depressions over the whole of the left side, starting from the roots of the hair and extending to the cheek; and there was likewise a deformity at the angle of the nose which presented the form of a spout.

When speaking to the patient in reference to the malformation, he placed his left hand over the left side of his face and said to us, "You will see each depression corresponds to the imprint of a finger, that the deformity of my nose corresponds to the imprint of the ulnar side of my hand. I came into the world with my hand applied to my face, and you have thus the explanation of the malformation which you observe."

That explanation appeared very unlikely to a professor of obstetrics to whom we submitted the case. He thinks that it is simply a coincidence. That the folds of the amnion alone and not a hand of a fetus would be likely to deform a face. We will not seek to clear up this question, but we will describe simply the state of the eye of the patient.

P. stated that until the age of thirty years he saw as well with the left as the right eye. It was at that time he lost the sight of the left eye. As he did not suffer and the physician of the village told him that he had cataract, he did not consult a specialist. It is, therefore, difficult to tell whether the disease was really at the outset that of cataract. When P. came to us he had an eye of stony hardness with a disturbance of the cornea, through which could be seen, as through a strainer, debris which appeared to us to consist of cortical crystalline matter. Having made an incision into the anterior chamber, we demonstrated positively the presence of the crystalline in that space. With a curette we extracted what remained of the nucleus, after which the cornea had recovered sufficient transparency for us to be able to see the instruments introduced into the anterior chamber. Our intention was to perform an iridectomy,

°Congrès d'Heidelberg, 1911, p. 377.

but we were unable to perceive the iris and we did not wish to do an operation blindly. We allowed the wound to close with the intention of doing what was necessary at a later date, for he had had no hemorrhage nor loss of vitreous, and we thought also that the extraction of the crystalline might suffice to relieve the glaucomatous phenomena. At the end of twelve days it became possible to examine the patient with the ophthalmoscope and by oblique illumination we found that there was complete aniridia. The fundus of the eye was entirely illuminable, the papilla was very deeply excavated, but we were unable to trace a single vestige of the iris. The extraction of the crystalline produced the effect that we desired.

After having instillated eserine for some months, the glaucomatous tension disappeared completely. We have seen the patient again at various times during the past seven years, and since the month of December, 1905, there has been no need for him to use the eserine.

This case shows that unilateral glaucoma, appearing at an adult age, may perhaps be attributable to a malformation of congenital origin, for as the patient says that he could see with that eye until the age of thirty years, and as his physician thought at the outset that there was a cataract, it is supposable that the aniridia was not congenital, but the iris became atrophied during the acute period of the glaucoma.

THE TECHNIQUE AND MODE OF ACTION OF THE RECENT OPERATIONS PROPOSED FOR RETINAL DETACHMENT.

Dr. Paul Bettremieux,
ROUBAIX, FRANCE.
Translated by L. Webster Fox, M. D., LL. D.

From a surgical point of view detachment of the retina has been often considered as a *noli me tangere.*

In 1887 Poncet, charged with furnishing a report upon the investigation of the French Ophthalmological Society relative to detachments of the retina, concluded that all the operative methods have that in common, that they lead to atrophy and sympathetic ophthalmia, but in clinical guardedness, not admitting that retinal detachment ought to be classed among the affections inaccessible to an efficacious surgical treatment, he closes the discussion with this phrase: "If up to the present time operative methods have led us but to danger of atrophy, I am far from thinking that we cannot find a more favorable method."

Fifteen years later Terrien (Chirurgie de l'oeil et de ses annexes 1902) expresses the opinion of the majority of oculists in saying that the therapeutic treatment of separation remains to be found. He is not in favor of surgical treatment, preferring the palliative means which he considers after all as generally insufficient.

In 1907, having the care of a case of peripapillary retinal detachment which failed to be relieved by the classical methods, and having in memory some cases of detachment manifestly cured or benefited by iridectomy or sclerotomy, and persuaded that sclerectomy acts in the same manner, I performed that operation. I obtained a result leaving nothing to be desired, a result which has been perfectly maintained.

This patient was presented on March 5th, 1908, to the Societé Medico-Chirurgicale du Nord, and I have had occasion since then to show him to several confrères. His case is reported in La Clinique Ophtalmologique (1908, p. 92). I have since that time systematically proposed simple sclerectomy to all patients who have come under my care with retinal detachment that appeared curable. I have gained the conviction that this treatment is far superior to all those which I had previously tried. In the hands of several confrères simple sclerectomy has cured detachment.

Some time ago Dr. Wibo (of Brussels) wrote me:

(1) Gauthier—Annales d'oculistique.
T. CXLIV, p. 430; Van Duyse. Bulletin de la Societé belge d'ophtalmologie No. 32, p. 14, et clinique ophtalmologique, 1912, p. 48.

"For several months I studied the effects of simple sclerectomy applied to several cases of detached retina. Certain cases are quite satisfactory and favorable to the method. In others the result appears to be nil or but slightly marked."

To sum up—it is a decided fact that simple sclerectomy, as I perform it, cures a certain number—a good number of retinal detachments.

In the case where the result of a first scleral incision is insufficient, one has recourse to a second, and even to a third sclerectomy. The cases most satisfactory in that respect that I have had under observation are those of the child whose case I have published,(1) and of the subject which I presented in November, 1910, to the Societé de Medicine du Nord (Annales d'oculistique, 1910, p. 427). The relapses have appeared to me rare, and in such a case one would have recourse to a new sclerectomy.

I explained the action of sclerectomy in detachment by my belief that in that affection an essential fact is the accumulation in the anterior chamber of aqueous humour at high pressure similar to the quick exit of the fluid in cases where one makes an iridectomy upon a subject affected with recent retinal detachment.

It appears certain that simple sclerectomy in lowering the tension in the veins of the anterior part of the uveal tract favors the reabsorption of the aqueous humour and modifies the blood circulation of the eye in a manner favorable for the cure of detachment of the retina.

Dr. Cusner (of Brussels), who performs sclerectomy, following a different technique to mine, is of the opinion that in all cases he forms a new vascularization visible with the binocular loop—anastomosing the superficial vessels with the deep vessels of the pericorneal region.

Recently M. Lagrange has proposed for the relief of detachment an operation which, according to the theoretical views of the author, is exactly opposite to that which I advise.

M. Lagrange sweeps aside the fact recognized by all oculists who have performed iridectomy in recent retinal detachments, when such is curable, namely, a gush of aqueous humour is produced after the sclero-corneal incision is made, proving that that liquid is in a degree of tension greater than normal. He takes as objective the lowered tension, which is a sign of detachment at a period of the condition when certainly it is much more difficult to cure. His aim

(1) Clinique ophtalmologique, 1908, p. 83, et bulletin de la Societé francaise d'ophtalmologie, 1910, p. 184.

is to close or to contract the excretory exits of the ocular fluids. To attain that object, M. Lagrange should, according to my opinion, have placed himself as exactly as possible under the conditions which physiologists are placed who have produced glaucoma experimentally, or realize surgically that which occurs in certain injuries of the sclero-corneal region which produce hyper-tension.

In reality M. Lagrange makes, in my opinion, a simple sclerectomy with this difference, that instead of excising with a knife the external layers of the sclerotic at the periphery of the cornea, he destroys them with a galvano-cautery. For my part, if I believed it useful to restrain the exit of the fluids of the eye from the excretory openings in the pericorneal region, I would carefully respect the external layers of the sclerotic, but I would destroy the conjunctiva and the sub-conjunctival tissue which cover them as broadly as I believed it possible to do so without danger.

Speaking of the technique of simple sclerectomy, I have several times advised the dissection of the conjunctiva and the sub-conjunctival tissue well down to the sclerotic; in the technique of colmatage of the eye, M. Lagrange advises the detachment of the bulbar conjunctiva of the eyeball in shaving the latter very close.

It appears surprising that pursuing, according to M. Lagrange, a diametrically opposed law, we should also perfectly agree upon this point of technique. In cauterizing the surface of the sclerotic M. Lagrange destroys the external layers which are an obstacle to the flow of venous blood from the eye. It permits the deeper layers to anastomose their vessels with those of the conjunctiva and of the sub-conjunctival tissue, care being taken in the dissection to press closely to the sclerotic.

M. Lagrange has said relative to the permeability of scleral cicatrices some things very proper to the subject, which all the world is agreed upon. He has said that the scleral fibrous tissue, immobile in its form, is incapable of proliferating, and consequently after the scleral excision the borders of the wound are not able to bulge out; he has said that certainly a simple thinning of the sclerotic facilitates in a large measure the flow of the liquids from the eye, and when, on the other hand, he writes that after performing sclerotomy, as I have advised, there results from the operative traumatism the formation of a cicatricial tissue which is perhaps capable of thickening the sclerotic, and later that the scar of that abrasion is perhaps lessened, but that it is certainly very dense, when recently he told us that in colmatage of the eye he closes the anterior openings of excretion, of the ocular fluids by

the superficial application of the galvano-cautery upon the sclerotic in the neighborhood of the corneal limbus in provoking an abundant production of fibrous tissue of new formation, I believe that M. Lagrange is mistaken; it seems to me he contradicts himself.

The fact that colmatage of the eye raises the tension when in detachment of the retina it is diminished does not prove that that intervention closes the openings for the excretion of intra-ocular fluids. The same fact has been observed after simple sclerectomy —likewise iridectomy often lowers the tension in glaucoma, and sometimes raises it in chronic irido-cyclitis. The peri-corneal scleral incisions and excisions can, in certain conditions, diminish the ocular tension when it is too great, and raise it when it is below the normal. That is explained if one admits that they form anastomoses between the superficial and deep blood vessels of the eye, whilst it is an incomprehensible fact if one wishes, contrary to all probability, to persist in believing that the fluids of the eye the peri-corneal incisions and excisions more than an enlargement pass out by filtration and not to realize in the mode of action of of a leak.

A CASE OF TUMOR OF THE PONS-CEREBELLAR ANGLE.

Drs. M. Danis and J. Geerts,

BRUSSELS.

Translated by J. Franklin Chattin, Newark, N. J.

This interesting case recently came under our observation and the following is the history: Jeanne Th., age 22, consulted the authors June 22, 1911.

Family history: Father and mother living and well, two brothers living in good health, one sister died in infancy of typhoid fever.

Previous history: Since the age of six the patient has walked with a limp; she has worn supporting apparatus and plaster casts; was operated on at the age of ten (section of the plantar aponeurosis). In 1903 patient noticed that the muscular power of her hands was diminishing. In 1908, three years before we saw her, the patient noticed that she was becoming deaf; ringing in the ears was also observed at the same time and a slight paralysis of the vocal cords was observed. The following year she experienced difficulty in speech, respiration and in eating and suffocation followed the slightest effort. Shortly after the vision began to fail and for several months past sudden changes of light or sudden movements were followed by a fog before the eyes.

Patient has had violent headaches, which have diminished in intensity; the headaches were localized at the summit and at the occiput.

Examination: The odors of essence of bergamot and ammonium sulphate were noted and recognized.

R. E. V.=20/xxx, L. E. V.=20/c. Visual fields not retracted, yet there was a central scotoma in the horizontal meridian (20° to 40° temporal). There was no dyschromatopsia.

Both discs choked; veins greatly dilated and tortuous; the left papilla was more congested than the right.

Paresis of the left orbicularis.

The superior and inferior recti, the internal, superior and inferior oblique muscles show nothing abnormal. Homonymous diplopia on looking to the left.

Homonymous diplopia on looking to the left.

Diminution of the sensibility of the skin of forehead, nose, upper lid and conjunctiva of the left side; bilateral abolition of the corneal reflex. Slight diminution of the sensibility of the skin of the cheek, side of the nose, lower lid and of the mucous membrane of the upper lip of the left side. No diminution of the sensibility of the skin of the auriculo-temporal region, of the lower lip, the gums, or the tongue.

Saliva not abundant; normal perception of taste for salt, sugar, acids and alkalies in the anterior two-thirds of the tongue. No deviation of the point of the tongue; the uvula is deflected to the left and reflexes are absent; the mucous membrane of the palate responds; the left anterior pillar is paralyzed; the left posterior pillar slightly so.

Frequent ringing in the ears; left tympanum slightly congested; right tympanum slightly retracted. Total bilateral deafness.

Acoumetric examination as follows:

Schwabach's test is shortened.

Rinne's test is negative.

Weber's test is central.

Watch heard by bony transmission in the right ear.

Struycken's monocord is not heard, neither by air nor by bone.

The nystagmic reaction with Barany's cold (20°) and hot douche (45° C.) is not present and does not influence the tendency to fall backward, even when the patient's head is turned to the right or to the left.

The patient was placed in a kneeling position on a chair and an electric current of 3 milliamperes, by the unipolar method (cathode applied to the tragus) without result, either on the opening or the closing of the current.

Nystagmus of rotation is absent, even after ten turns, the head being in normal position or inclined forward, nor by the use of the nystagmograph. However, it was noted that on the nystagmographic charts that there were some slight nystagmographic tremors towards the right or towards the left. It was noted as a particular fact in some of the tests made at the beginning of the examinations, that the patient showed on the nystamographic charts the normal nystagmus of alternate movements whilst she was making spontaneous movements of the head. In Barany's index test neither the right nor the left hand were in error after ten rotating turns to the right or left.

Sense of taste abolished in the posterior third of the tongue; the general sensibility of the mucous membrane of the palate and pillars is also absent; nauseous reflex not present. There is lack of innervation to the vocal cords; they remain separated at their posterior part (paralysis of the adductors); the right cord having a little more motion than the left; the right arytenoid tends to override the left; the voice is hoarse, but less so if the head is inclined to the right.

Pulse accelerated, 124 to the minute.

Intermittent headache, localized at the summit of the cranium and at the occiput; frequent uncontrollable vomiting; no convulsions or loss of consciousness; occasional vertigo; rapid fatigue; abnormal gait. The patellar reflex at the first percussion was absent, at the second or third tap there was a slight reflex and at the fifth or sixth stroke the reflex became violent; tendo-achilles reflex absent; Babinski and ankle clonus absent. Muscular atrophy of the forearm, right wrist 13.5 cm., forearm 20 cm., left wrist 14 cm., forearm 21 cm. Intense dermography. No adiadocokinesis.

Patient leans to the right when walking, which is difficult to observe on account of the malformation of the feet, yet it is sufficiently apparent. Romberg positive. Dungern-Wasserman reaction is negative; urinalysis shows the kidneys to be normal. Lumbar puncture was not done because of possible complications.

Symtomatology: The symptoms about to be enumerated may be classed in two groups: First, symptoms of compression or of intracranial tumor; choked discs; vomiting; headache, vertigo, intellectual failure and cardiac disturbance. Second, symptoms of localization: the symptom which should first attract us is the lack of function of the auditory nerve; early development of noises in the ears; diminution, then failure of hearing; the acoumetric examination shows that the auditory function of the cochlear nerve is completely abolished, also the vestibular root; the labyrinth does not react. The facial nerve is less affected than the auditory; the trigeminal is slightly affected; the external branch of the oculimotor is involved, as is also the hypoglossal and the pneumogastric.

Further, there are symptoms of brain compression; as a proof of compression disturbance of the motor areas, there was shown a diminution of the muscular force of the arms and, finally, to demonstrate disturbance of the general sensibility, we have the muscular atrophy. The *tout ensemble* of these symptoms permits us to make the diagnosis of tumor of the left pons-cerebellar angle. Reflecting on the long duration of the illness, the opinion is ventured that the tumor is large.

Course of the illness: On July 18th the vision was R. E. 20/xl, L. E. 20/c.

On account of the increasing loss of vision we asked Professor Depage to do a decompression operation, and on July 2, under chloroform anaesthesia, Dr. Depage made a large musculo-cutaneous flap to the base and trepanned the bone, removing it; the

meninges were intact and the intracranial pressure was so great that the brain protruded. The meninges were not opened and the flap was replaced and sutured. The after effects were not abnormal, except for a rise in the temperature for the first few days; on the fifth day it reached 39.6° C. and the patient passed a very bad night, having tonic and clonic convulsions of the arms, legs and face. The day following the operation we noted ophthalmoscopically that the right papilla was less choked but more pale; that the left papilla was less choked, that the veins were much less swollen and that the retina presented foci of degeneration.

July 31, the patient noted a subjective improvement of vision; the headache had disappeared and the papillary stasis continued to diminish.

August 5, patient tells us that vision continues to improve; retinal veins much less tortuous; choking of the discs rapidly diminishing, but the papillae are pale.

August 11, patient complains of a great reduction in her vision; the inflammatory phenomena continue to grow less, but increasing pallor of the discs is apparent.

August 17, we noted that the vision of the right eye, nasal side and left eye, temporal side was abolished (homonymous hemianopsia).

August 23, R. E. V.=20/c, L. E. V.=fingers at one foot, to the temporal side. The visual field is concentrically contracted in the right eye and it is impossible to take that of the left eye. The choking of the discs has completely disappeared; the vessels have diminished in volume, but there is now double atrophy of the optic nerves. Patient can not walk alone, help being required to sustain her; the deviation in walking is increased and the deafness persists. The general condition of the patient is becoming worse and worse.

At the end of September Dr. Depage decided to operate again. An incision was made the same as at first; the flap was found to be adherent to the meninges and sinus; while dissecting the meninges from behind, an opening was made into the sinus, causing a severe hemorrhage from which the patient died. The tumor was then enucleated very easily by the fingers, which proved to be a tumor of the left pons-cerebellar angle, situated behind and under the tentorium cerebullum.

Owing to an unfortunate misunderstanding the brain was not examined. The tumor alone was kept and was found to be 37 millimeters in length by 31 mm. in width.

Histological report: Fuso-cellular glioma.

The history of this case again demonstrates the necessity of a minute ocular examination in cases where there are intracranial pains and ringing in the ears, which are too often attributed to a local affection, such as chronic tubular catarrh, a diagnosis which was made in the beginning and on several occasions in our patient.

The amelioration of the pain and the visual improvement, even though slight in this case, prompts us to believe that decompression should always be attempted. The result would have been much better had the operation been done earlier, although there had surely been produced a diminution of the intracranial pressure, but from a visual point of view the intervention came too late, as the optic nerves were already undergoing atrophy.

LEPROMA OF IRIS CURED BY RADIUM-THERAPY.

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LEON, MEXICO.

Translated by Dr. Francisco Ma. Fernandez, Havana.

Leprosy may invade the iris either primarily or as a secondary complication, the original lesion being then in the cornea, sclera, or any other place, but in any case the infection is of endogenous origin, that is, it always is the result of some metastatic process and carried to the iris by the blood. Iritic manifestations of leprosy are not rare. In 87 cases of ocular leprosy Lyder Borthen, of Trodhjem, Norway[1], has seen the uveal tract affected 32 times, or in 36.7 per cent of the cases observed.

The clinical varieties of the leprosic iritis are well defined by Dr. J. Patron Espada in a work read before the Ophthalmological section of the III Pan-American Medical Congress of Havana (February 4, 1901)[2]. This author described besides the *serous iritis,* another form of iritis, not described before, and in which the color of the iris is not affected, but the principal feature of which is the presence of numerous grayish granules of the size of a pin's head, more abundant near the pupillary opening. In one of his cases there was no reaction, while in another there were synechiae of the pupillary margin, all symptoms of the disease disappearing in the first case after six months had passed.

The more common form of leprosic iritis is the plastic form, with the formation of pupilar exudate, more or less thick. It seems to me that Dr. Morax in his work posterior to the *French Ophthalmological Encyclopedy*[1] has had in mind the work of Dr. Patron Espada, *although he does not mention it,* because he says: Leprosic iritis may present three aspects. In the first type the disease does not differ much from the ordinary serous iritis and only by the history and other leprosic lesions it can be differentiated from the specific or blenorrhagic forms. In a second type *the surface of the iris is covered by a crop of small grayish points, which can only be seen with the magnifying glass,* and which are more abundant near the esfincter, its appearance being unaccompanied by any inflammatory reaction. The more common type is accompanied by pupillary exudates. Lastly, there may be observed, more rarely, a third type characterized by the development of large lepromata, which usually appear in the root of the iris and develop themselves in

(1) Cited by E. Venneman, of Lovaine. Encyclop. Fran. d'Oph., VI.
(2) Ocular manifestations of Leprosy. Anal. de Oftal. Vol. III.
(1) V. Morax. Examen du malade et Semiologic oculaire. Enc. Fr. d'Opht. IV, 1905.

the angle of the iris, giving rise, sometimes, to very violent signs of ocular irritation.

In my practice I have had some cases of serous iritis and of the plastic form in poor lepers, and I can say that they can be relieved, specially the serous form, with therapeutic measures. I have never seen the miliary leproma described by Dr. Patron Espada.

But I had the opportunity of observing a case, very interesting, of a large isolated lepromata, planted on the level of the pupil and accompanied by intense reaction, exudates and marked diminution of vision. I believe this case to be interesting not only because the large lepromata of the iris are very rare, rarity confirmed by Patron Espada and Morax and the Norwegian observers, that have great experience on account of the endemicity of leprosy in Norway, but also by the situation of this lepromata in the pupillary margin, for most cases have their lepromata in the angle of the iris, and also, and very especially, because of the extreme rapidity with which the inflammatory reaction disappeared and by the disappearance of the tumor itself after three months of treatment by radium therapy, the patient recovering normal vision.

Description of the case. Mr. J. S. R., a man of 43 years of age, judge in one of the larger cities of this State, presented himself to me for consultation in December of 1911, stating that he had had very intense pains for two weeks in the left eye, vision being almost nil in that eye. He stated that he never had had any ocular disturbance, but that for the past three weeks his legal work had increased considerably and that one day on going out of his office he had caught a cold, after which the eye became painful and began to get red. These symptoms increased in intensity; his sight began to fail on the affected side and his family physician recommended to him to consult a specialist, because he thought that his eye trouble might have some connection with his general disease (leprosy).

On examination I at once discovered the existence of tubercular leprosy, the man being a *lazarine*[1].

Although usually the first part invaded by the lepromata is the face, as it seems that the nasal mucous membrane is the portal of entrance of Hansen bacilli, this belief being the result of an inves-

(1) In this State of Guanajuato, and also in Jalisco, Micheacán and Zacatecas and S. Luis of Potosi tubercular leprosy patients are known as **lazarinos***, while the nervous leprosy which produces anesthesia and mutilations is known as **Mal de San Antonio** and its patients are known as **antoninos** or **toninos.**

*The disease being known as **Mal de San Lazaro.**

tigation realized by me in the years 1901 and 1902[1], in my patient there were very few in the face: the auricle had very scarce and small tumors and in the right side of the face as well as in the chin two large leproma were present. This was all that was found in the face, which not even had madarosis or falling of the brows, which is such a frequent and early lesion of leprosy.

As a contrast the hand and forearms, the thighs and the whole back had abundant voluminous leprosic tumors, many of them being ulcerated and the others covered by grayish crusts covering another ulceration.

The clinical diagnosis of leprosy can not be discussed, but to render the diagnosis more certain the microscopic examination, made by Dr. F. Gonzalez Favela, was positive. In a letter given to me by the patient the above-mentioned doctor stated that much.

The disease began three years before and the first lepromata appeared in the left thigh. This rare initial localization may have something in common with the way in which the contagion was acquired.

The patient was born in the capital of the state and there were no hereditary dates, but he had lived during nine years in Isapuato and two years in Abasolo, both places having a great number of leprosy patients. He had complete lack of specific history.

Examination of the eyes in December, 1911. Right eye, well. The eyebrows, eyelids and lashes of both eyes well, excepting a marked pigmentation of the skin of both lids and which was noticed in the whole face. I am inclined to believe this pigmentation as due to leprosy, because most of the patients I have observed had a dark reddish tint in the skin of the face and hands, which is suspicious, especially if accompanied by edematous infiltration of the skin.

Left eye: Intense redness around the cornea, the cornea being transparent; opaque iris; contracted pupil and an exudate occupying the same; a large tumor, of 2 or 3 mm. in diameter, was implanted in the free inner edge of the iris toward the lower and external segment (place of more frequent occurrence), and projecting in the anterior chamber. This tumor had a light yellow color, contrasting with the dark coffee color of the iris, and its surface was irregular. Vision reduced to less than 1 per cent: the large letters of the scale of Dr. Uribe y Troncoso, calculated to be seen at 50 meters, were hardly seen at a distance of 50 centimeters.

(1) Etiology and Therapeutics of Leprosy. Essay that was given a prize by the National School of Medicine, of Mexico, by the author.

The eye was painful to the touch and also spontaneously and the tension was increased.

I instilled dionine solution to relieve the pain as well as to produce the lymphatic inundation of the conjunctivae in order to lower the pressure, and when this was obtained a few drops of atropine were instilled on the eye.

December 14. Almost the same picture, but the pains had diminished considerably and the pupil had begun to dilate very irregularly, showing the existence of synechia, especially at the level of the tumor. New instillations of atropine and dionine.

December 15. Marked diminution of the pains. Complete dilatation of the pupil, except where the tumor was adherent to the anterior capsule, giving the pupil an oval shape. Over the anterior capsule some *debris* of the iridic synechia. Vision improved. That day I had a picture made of the patient's eye, having a painter to do it, so as not to lose any of the details.

Diagnosis. The existence of leprosy, proved both clinically and bacteriologically, and the complete absence of specific infection, made easy the diagnosis. To me there was a thick leproma of the iris, accompanied by an intense inflammatory reaction, of a true plastic iritis. The tumor had a remarkable resemblance with some condylomata of the iris of syphilitic origin. Compare the picture of this case with Plate XXXI of the Atlas of external diseases of the eye, by Haab Terson, which represents a specific iritic condylomata, and a great resemblance will be noticed in the situation, figure and color of both. And this is so because the reaction of the iris is the same in these cases.

Treatment. In the presence of such leprosic manifestation, endangering the functions of one of the most important organs, what therapeutic road should be followed? Of course, the classic treatment of iritis had to be followed in order to relieve the severe pains and the synechia that were formed, and for this atropine was ordered, but before we had to make use of dionine so as to bring about the lymphatic invasion of the conjunctivae. Hot applications over the closed lids and antipirine were used to combat the pain, but there remained the leproma itself to be cured, and it was impossible to obtain that with the general anti-leprosic treatment only, for this we perfectly know rarely checks the disease, besides being of very slow procedure. A surgical intervention could not be recommended because an iridectomy in an inflamed place so full of bacilli would have been disastrous.

We had to obtain from fisio-therapy what chemistry denied us.

Then we thought of Roentgen's rays, because the histological nature of leproma is somewhat similar to fibro-sarcoma. In a case of Meyer and Berger[1] such a resemblance was noticed. In every leprosic tumor there is abundance of leucocites, of free Hansen bacilli and of bacilli inclosed in small cells, and in this cellular infiltration numerous blood vessels develop. The histological fact to be remembered is the abundance of leucocytes and new cells, and we well know that the X-rays have influence upon the lymph tissues and young tissues of new formation[2]. Theoretically, then, Roentgen's rays should be used on my case.

For more abundance of reasons the following facts should be remembered: *First,* the morphologic and biologic resemblance of Hansen's and Koch's bacilli and their analogous reaction to the coloring process of Ziehl-Nelssen; *Second,* the good results obtained with X-rays in tubercular manifestations, in lupus, for example. With the hope of this reasoning, I had Dr. C. Lários to make the applications of X-rays to my patient. Four exposures, of five minutes' duration, were made on the following days: December 15-18 and 31, and March 24 of this year on the eye, and those same days and twice in January and once in February on the other places of the body, where the lepromata were more abundant.

The results were extremely satisfactory. The iritis disappeared completely. The pupil reacts to light and accommodation, the iris is normal and so is the vision when corrected in the following way:

R. E.=Sph. —1.50, Cil. —0.50, Axis 90°
L. E.=Sph. —1., Cil. —0.50, Axis 70°

With the first three exposures the progress was very marked, there remaining on the 23d of March as a remaining of the leproma a small yellow stain on the iris, in the place where the leproma originally existed, and a small synechia on the same place.

Hoping to make these disappear I ordered a new application made on the 24th of March. All exposures were well stood by the patient and there was not the least sign of dermitis. The cutaneous lepromata and ulcerations were well affected by the radium-therapy and they have diminished in size. Although it may not yet be the time to proclaim X-rays as the curative agent of leprosy, we can affirm that they are a powerful agent for the

(1) Meyer and Berger, Leprosie tumour of the cornea, of sarcomatous aspect. Archio fur Opht. XXXIV.

(2) Delherme. Third Chapter on Electro-theorapy and radium-therapy in Les Agents Physiques usuels. Paris, 1909.

tims to segregate themselves from the rest of mankind, ought to make us rejoice at having even the possibility of hope.

same, and the terrible ravages this disease causes, obliging its victims to segregate themselves from the rest of mankind, ought to make us rejoice for the possibility of a cure.

A RESUME OF THE PRESENT OPERATIVE TREATMENT OF TRACHOMA, WITH A DESCRIPTION OF THE AUTHOR'S METHOD OF GRATTAGE WITH STRIPS OF STERILIZED SAND PAPER.*

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Recent investigations as to the etiology of trachoma by Halberstädter, Prowazek, Greeff and others have led to the hope that along with the discoveries made, a cure for the disease might be found. But the etiology is not yet firmly established, and in the meantime in the absence of any specific treatment, which, as the result of investigations, may come later, we are confronted by the fact that the surgical treatment of trachoma yields the best results.

The diseased structures are best gotten rid of by mechanical means the same as cancerous tissue, although possibly caused by a protozoon, is best eradicated by the knife.

Therefore, the author in presenting this paper desires to consider only the surgical treatment of trachoma. This includes the various methods for removing granulations such as scarification of the conjunctiva, abscission of the granulations, excision of the retro-tarsal fold; squeezing them out with the thumb nails, or with specially devised forceps; picking them out one by one with a fine needle, and emptying their contents; or burning them out with a heated wire or galvano-cautery, or destroying them by electrolysis.

Exuberant granulations have been scraped away with a small rake or sharp curette, or removed by rubbing them briskly with a stiff brush or gauze, and lastly coming under this head, the author's form of grattage with strips of sterilized sand paper.

Few of these operative measures are adapted to every ease, and in order to judge of their relative merits it will be necessary to give a brief description of some of the more complicated ones.

Knapp's operation with his specially devised roller forceps is described in all the text books and the various steps of the procedure need only be mentioned here to illustrate its advantages and disadvantages and in what class of cases it is particularly applicable. The application of the forceps is usually preceded by a scarifying of the infiltrated area, preferably with a three-bladed scarifier. One blade of the roller forceps is pushed deeply between the ocular and palpebral conjunctiva and the other is applied to the everted surface of the tarsus. The forceps are compressed with

*A description of this operation appears in The Ophthalmic Year Book, 1909, Vol. VII, p. 137; The Practical Medicine Series, 1910, Vol. III, p. 47; and Wood's System of Ophthalmic Operations, Vol. I, p. 895.

some force, drawn forward and the infiltrated soft substance squeezed out as the cylinders roll over the surface of the fold held between them. This maneuver is repeated until all of the morbid material has been expressed. This form of expression yields the best results in cases of spawn-like granulations and diffuse hyaline infiltration, but is not well adapted to the other varieties. With the forceps the smaller granulations are not gotten rid of, the rollers generally passing over them, and it is in the smaller granulations that we have the seat of the disease. Again, by the operation it is only the granulations that are located in the lid proper that are destroyed, those in the fornix generally not being reached at all.

Noyes' forceps for expression act in a similar manner. Fox of Philadelphia excises the granular form with the scissors. He also scrapes the tissue down to the basement membrane with a scoop or scalpel.

Heisrath's[1] excision of the retro-tarsal fold, while radical, has so far not been practiced to any great extent by American surgeons. When the operation is done, as it usually is, on the upper lid, the latter is everted so that the convex border of the tarsus is thoroughly exposed. This is now firmly grasped by two strong-toothed forceps at the junction of the middle with the outer and inner thirds of the tarsal margin, and drawn firmly upward by the assistant standing at the patient's head. The junction of the palpebral and ocular conjunctiva is now fully exposed and may be readily examined. Following as nearly as possible the margin of the diseased area, an incision is made from the outer to the inner canthus, through the conjunctiva only. Unless in consequence of previous mechanical treatment the conjunctiva is bound down to the underlying tissues, the wound will gape and the fibers of Mueller's muscle may be recognized. Three stitches should now be passed through the bulbar margin of the incision, care being taken to include only the conjunctiva and a few of the fibers of the submucosa. If more than a mm. in width of conjunctiva is included in the sutures, small symblepharon folds may form opposite each, and if too deeply inserted there will be a noticeable dragging on the lid edges.

Dr. Wood uses a specially prepared silk suture, which he claims is much less likely to irritate and abrade the cornea or bulbar conjunctiva.

(1) Wood, Casey.—Exsection of the So-called Tarsal Cartilage in cases of Chronic Trachoma, American Journal of Ophthalmology, Vol. XX, No. 7.

Once introduced through the lower wound margin, the threads should be allowed to hang down over the globe and to rest on a sterilized towel placed on the cheek. After the sutures have been thus placed, the bulbar conjunctiva should be separated from the globe a distance of 3 to 5 mm. from the edge of the wound. The forceps may now be removed from the convex border of the tarsus, and the lid margin be grasped at its middle point, a horn spatula being passed behind the everted lid. A second incision running the whole length of and parallel to the lid edge is now made as nearly as possible in the healthy conjunctiva. Sometimes this will be three, sometimes even five mm. from the palpebral border, the intention being to remove as little of the infected mucous membrane as possible and so to leave as large a portion of the central conjunctiva area as is consistent with the needs of the case. The spatula may now be removed, the assistant drawing the lid upward and backward with one or two fixation forceps. The operator then seizes the tissues at the nasal junction of the two incisions and with scalpel and scissors slowly excises conjunctiva and tarsus, carefully avoiding the orbicularis and Mueller muscle. At this point the anesthetic may be removed and time allowed for the bleeding to cease. As a rule there is not a great deal of hemorrhage, although some small branches of the arterial supply may have to be twisted.

The conjunctival sac should be thoroughly irrigated and the lips of the wound brought together. To secure a satisfactory result one must be particular to place each suture in both wound margins so that it will be exactly opposite its fellow when the eye is closed. It is also requisite that the bulbar conjunctiva should not be put too much on the stretch. The middle suture should first of all be tied with a single knot, and it is wise to make certain, by closing the lid, that the precaution just mentioned has been taken before the final knot is tied.

The operators claim that there is little subsequent pain and very little reaction.

The sutures are removed on the fourth or fifth day. In a week or ten days the wound is usually quite healed, but the sac should subsequently be examined for the presence of granulation tissue or irregular wound margins. These are best clipped off or trimmed with scissors.

It is advised by some operators that no stitches be used, owing to the possibility of corneal lesions. But Wood claims that if the stitches are properly prepared there is no danger of this and the

healing occurs sooner and the cosmetic effect is better when they are employed.

The possible complications of the operation are ptosis, entropion, corneal ulcers and the production of irregular symblepharon-like folds in the region of the sulci.

Again, the operation cannot be applied to every case of trachoma and it presents the objections of a rather complicated technique. In those cases where the disease has practically died out in the mucous membrane, but is active in the submucosa and tarsus, Kuhnt suggests the excision of a part or the whole of the so-called tarsal cartilage.

Wootton[2], speaking of these operations, says: "They are contraindicated in the follicular trachoma of children. Neither operation has for its object the cure of the patient with the restoration of normal conditions. The combined excision is in fact a surrender. It recognizes the practical impossibility in clinical practice of curing the cases by any measures which seek to preserve the normal state of the tissues, and simply aims to anticipate by years the natural cure of the disease, with the avoidance of the untold suffering and damaged vision resulting from corneal complications. The resection of the tarsus finds its most useful application in the cicatricial stage when the trachomatous process has run its course and the patient's sufferings are apparently due to the presence of the distorted cartilage."

The tooth brush and gauze are the means usually employed in the operation known as grattage. Here the conjunctiva is first scarified as in the forcep operation. If the tooth brush is used it is generally dipped in a solution of bichloride of mercury 1/500 or 1/1000, and the conjunctiva vigorously scrubbed. Plain gauze is used in a similar manner or gauze dipped in dry boracic acid is preferred by some surgeons. With the tooth brush the bristles do not present a uniform rough surface and the granulations of the lids cannot be ideally smoothed down by them. The gauze if properly manipulated presents a more ideal surface, but as soon as it becomes the least bit blood soaked it loses its rough character.

In connection with the methods of grattage mention might be made of Burrows' operation, which consists of cutting through the cartilage from the inner to the outer canthus. If performed at the same time as the grattage, it assists materially in the operation by expanding the eyelids.

The use of electricity in trachoma may be confined principally

(2) Archives of Ophthalmology, March, 1910.

to electrolysis as practiced by Meyer of Philadelphia. A 30-cell galvanic battery is employed, together with a reliable milliampere meter. A current of 1½ to 2 milliamperes is usually sufficient. The lids should be everted and a four per cent solution of cocaine be instilled for its anaesthetic effect. The needle attached to the negative pole is inserted into the granulations, after which the positive pole is placed in contact with the back of the neck. The vessels supplying the granulations should be attacked when possible. The effect of the current is shown by the coagulated material which collects about the needle. The debris should be removed by irrigation by means of a boric acid solution. The number of punctures made at a single sitting is seldom more than four or five. For large granulations a wire ring is employed the same thickness as the needle. Flat electrodes are decidedly less valuable than the needle and are more often followed by scarring. There is said to be very little reaction following. This method of treatment is only applicable to those cases characterized by the presence of isolated trachoma follicles.

In the author's operation the grattage is performed with strips of sterilized sand paper. The technique of the operation is as follows:

A general anaesthetic is used. Somnoform works well as the time occupied by the operation is short. The conjunctival sacs are thoroughly cleansed with a boric acid solution. No. 0 or 00 sand paper is used and it must be ascertained if it is pure, as some contain an admixture of powdered glass. The paper is cut into strips three to four inches in length by three-fourths of an inch in width. These can be sterilized by dipping them into alcohol and then burning it off. Care must be taken to prevent the alcohol from burning too long, as the heat will destroy the sandy surface, making it unfit for use. Sterilizing by dry or moist heat acts equally well.

The upper eyelid is now grasped along its margin by a Darier forcep and the edge being turned upon itself, the lid is everted until the retro-tarsal fold is brought into view. This thorough eversion is very necessary, for it is well back in the retro-tarsal folds that the granules are found in greatest abundance. In fact the tarsal surface proper may show only a few isolated granules, while the retro-tarsal region will be thickly studded with them. Again, the forceps must lock so that the lid can be held firmly. If not and they are allowed to slip we may have tearing of the conjunctiva, which although of little consequence is unnecessary. A

horn spatula is next inserted beneath the lid to protect the cornea. This is very necessary for although we may acquire a deftness in manipulating the sand paper so as not to touch the cornea it is best to protect it in such a way that there is no possibility of injuring it.

The strip of sand paper is next rolled lengthwise over the index finger and holding it firmly between finger and thumb the entire lid surface and exposed retro-tarsal folds are thoroughly and briskly rubbed. By holding or rolling the strip of paper in different ways all the recesses can be reached and the entire surface rubbed down smooth.

If the lower lid is involved in the trachomatous process, it should be treated in exactly the same way.

The surface of the lids and entire conjunctiva sac is now thoroughly irrigated with sterilized water or normal salt solution and all blood washed away, including any sand particles that might have been dislodged from the surface of the paper, although the operator has never observed any come away, nor has any foreign body ever been discovered in the eye after the operation.

A dressing consisting of cotton or gauze soaked in either of the above solutions is applied and held in place by a light but firm bandage. Cold applications are used for five or six hours after the operation and the eyes cleansed at intervals.

At first thought one might conclude that the operation would be followed by great reaction, but it is not. The reaction is insignificant, the patient returning the next day with the eyes open.

Upon examination it will be found that the conjunctiva is covered with a slight exudate, which generally remains for four or five days. During this time and as long as there is any secretion, a solution of nitrate of silver (gr. 2 to ℥ 1) is applied once in twenty-four hours to the everted lids. After the exudate has disappeared, 1% ichthyol in vaseline is used once daily, or 1-500 solution sulphate of copper until all induration and thickness leaves, which is accomplished in from four to six weeks. At the expiration of this time the lids take on their normal appearance.

The general conclusions to be reached by a study of the different methods of operating for trachoma are:

First: That the operative treatment yields better results in the majority of cases than the medical.

Second: That in view of this, and in the absence of any specific treatment that may come with the discovery of the cause of the

disease, operative measures should be employed early before radical changes take place in the lid tissue.

Third: That few of the operations described can be employed in every case.

Fourth: That in any of the operations for trachoma, complete eversion of the lid so that the entire retro-tarsal region is thoroughly exposed, is absolutely necessary for the success of the operation.

The author claims the following advantages for his operation:

First: That it is applicable in all forms of the disease; even in the old cicatricial type it acts beautifully, smoothing down the rough and hypertrophied portions of the conjunctiva.

Second: There is very little reaction. In none of the cases on which I have operated by this method (which covers a period from 1906 to date) has there been a severe irritation or a single corneal complication following. Dr. Daniel W. White and Dr. George Phillips of the U. S. Indian Service report 1,200 cases among Indians operated upon by this method with good results. Dr. White says since he introduced sand paper for operative procedure in the Indian Service, the Indian does not have the annoyance he had when the forceps were used[3].

Third: By this method of grattage, the smaller granulations in process of development are removed, as well as the larger, and the long after-treatment with caustic applications is not necessary.

412 Metropolitan Building.

(3) Ophthalmic Record, May, 1912, Vol. XXI, No. 3, p. 223.

RECURRENT THIRD-NERVE PARALYSIS WITH REPORT OF A CASE.

J. Ferdinand Klinedinst, M. D.,

York, Pa.

(Read before the Section on Eye, Ear, Nose and Throat Disease, Medical Society of the State of Pennsylvania, Harrisburg Session, September 27, 1911.)

This strange and rare form of paralysis has been seen by few ophthalmologists, judging by the few cases reported in the literature, and especially in books on ophthalmology, many of them not even containing a description of the malady. Cases have been reported by deSchweinitz[1], Leszynsky[2], Sachs[3], Weber and Onuf and Posey [4], some typical while others are not true cases of recurrent oculomotor palsy. Various causes have been advanced by different authorities as to the etiology of this form of palsy. Oppenheim[5] says:—

Cases of oculomotor paralysis have been observed by Gubler, Camuset, Saundby, Mobius, Senator, Pflüger, Vissering, Charcot, Manz and others in which there occurred from time to time, generally at regular intervals, a paralysis of the oculomotor nerve, which again disappeared after some days, weeks or months. Children were generally affected; a nervous predisposition was not noticed. There occurred with the paralysis, which generally attacked the same nerve (not passing from one side to the other), headache or pain in the eyeballs, the forehead, or the whole front of the head on the side of the paralysis, with nausea and vomiting. The headache generally had the character of migraine attacks, returned every four weeks or at longer intervals, and was almost always accompanied by the oculomotor paralysis. It is the rule that this begins the attack, and disappears when the other symptoms come on. In contradistinction to typical migraine, the headache and the vomiting may last for a week. This paralysis involves generally the whole oculomotor nerve; in some cases some of the branches were spared. The paralysis may even confine itself to the levator palpebræ superioris (Knapp). A decrease in sensation of the region supplied by the first branch of the trigeminal was observed in some cases.

There are cases of purely periodical and of periodical exacerbating (Senator) oculomotor paralysis. In the latter type a paresis of the nerve or of some of its branches, which may increase to total paralysis, is present between the attacks; in the first we find nothing in the intervals. It also occurs that the paralysis disappears after the first attack, but persists partly later on.

We do not know anything positive concerning the cause of these symptoms nor the seat of the disease. Some, as Mobius and Brissaud,

1. Boston Med. and Surg. Jour., 1895.
2. Med. Record, May 25, 1901.
3. Jour. of Nerv. and Men Dis., 1901.
4. Extracted from A. Jour. of Med. Sci., April, 1905.
5. Diseases of the Nervous System.

assume a nuclear disease; others, and the majority, a basal disease. In the cases which came to an autopsy (Gubler, Weiss, Thomsen-Richter, Karplus), the trunk of the oculomotor was found diseased; in one, a plastic exudate, in the others a neoplasm (tubercle, fibrochondroma, neuroma) was found. Many views are expressed—functional disturbance, local hyperemia, vascular anomalies, and the like, to account for the symptoms. The most plausible is that of Charcot, that periodical oculomotor paralysis is allied to hemicrania, and probably the latter, also, can be referred to vasomotor influences. A vascular spasm inhibits the flow of blood to the nerves, and thereby produces the paralysis; or the arterial nerves become paralyzed, and the overfilling of the vessels produces a corresponding compression of the nerves.

These attacks may recur many times without injuring the nerves. But in time a degenerative and inflammatory process takes place, which is not capable of complete retrogression.

It should also be understood that a circulatory disturbance recurring like this one can be the starting point for exudative processes and neoplasms.

Charcot emphasizes its intimate connection with migraine, and spetaks of "migraine ophthalmopegia."

Fuchs[6] says:—

To the paralysis of basal origin belong most cases of periodic paralysis of the eye muscles. Such paralysis most frequently affects the oculomotorius. The attacks are ushered in by headache which is often associated with vomiting (ophthalmoplegic migraine). After these symptoms have lasted for some days, the paralysis sets in. After some days or weeks this either disappears entirely or leaves a paresis of the muscles that lasts till the next attack. The disease often begins in childhood and ends either in recovery or in permanent paralysis. Some of these are of purely functional nature (hysterical). In others there is a basal lesion, a circumscribed exudate or small new growth that presses on the nerves.

The case I shall report is a most interesting one, and I think I have by its study found one of the determining causes.

On April 26, 1911, Helen H., aged fifteen years, a resident of the northern section of York County, an employee in a whip factory, consulted me for treatment of ptosis. The patient is a tall, fair-complexioned girl, well built and nourished.

She and her mother give the following history: When three years of age she suffered from severe pains over right side of head, which was followed by ptosis of right eye, continuing for a week or more and then recovery took place from the paralysis. These attacks occurred once a year, in the early spring time, never at any other time of the year. During the attacks in childhood she would become languid, with loss of appetite, never any nausea or vomiting. The attacks have occurred every year except when she was thirteen years of age, the year during which she began to menstruate. They have occurred yearly since, in the early springtime.

6. Fuch's Diseases of the Eye.

Examination: There is ptosis of the right eye with moderate dilatation of the pupil. There is palsy of the levator palpebræ, the superior, inferior and internal recti, the inferior oblique, the sphincter pupillæ, and the ciliary muscle. There is diplopia; vision, O. D. 15/30 and O. S. 15/20. Ophthalmoscopic examination reveals nothing abnormal.

Patient and mother state that present attack began with severe pain in right side of head, followed five days later by palsy. The pain begins about one inch posterior to the tip of right mastoid region and travels over occiput to the vertex, then to the frontal region and localizes itself in the right eye, continuing for several days, followed by paralysis. The paralysis develops slowly. If pain begins in the evening there is migraine in the morning. Present attack began the morning of April 16 with pain back of ear, and eye closed gradually Ptosis was complete the morning of April 21; before ptosis occurs there is diplopia.

There is no involvement of any other cranial nerve, no loss of sensation, no loss of taste or smell. Examination of urine shows no albumin, sugar or tube casts. There is, however, a moderate amount of indican; there is no disease of heart or lungs, no evidence of syphilis or other systemic disease. Reflexes are normal; there is no organic disease of nervous system, no disease of any of the sinuses. The attack nearly always follows a period of constipation in the early spring. Menstruation has been regular since thirteenth year.

Family history: Patient's father and mother are living. Father has alleged tuberculosis of throat; mother is in good health except for attacks of migraine with vomiting, which occur about once a month, usually following sluggish bowels or constipation. Father's mother died of tuberculosis but did not suffer from migraine. Maternal grandmother suffers from migraine. Patient has six sisters, four of whom suffer from frequent headaches but there is no palsy of any cranial nerves. One suffers from rheumatism. One of the sisters, aged twenty, suffers from migraine of the right cranium but has never had any paralysis of any cranial nerve; neither are her headaches periodical. Mother states that all their headaches follow a sluggish condition of the bowels. No other member of family has had any palsy of cranial nerve.

Treatment: The patient's eyes were kept under the influence of atropin until palsy had disappeared. She was also given, internally, one grain of mercury with chalk and given smoked glasses to wear. On May 6, patient returned for refraction of eyes. There was no evidence of palsy of muscles; eyes were still under atropin cycloplegia. She stated that on May 4 the ptosis began to subside gradually, preceded by a jerking motion of the head and clonic spasm of the lids of the right eye. The following day eye was open with some diplopia. Vision under atropin was O. D. 15/60 with plus 1.50 sph. equals 15/15. There was left hyperphoria of 1 degree, O. S. 15/60 with plus 2 sph. equals 15/15. There was no muscular imbalance except left hyperphoria of 1 degree. I prescribed plus 1 sph. each eye, to be worn constantly. She has resumed her work in whip factory and has had no trouble with eyes.

As most authors says, the etiology of recurrent oculomotor paralysis is obscure, since only in a few cases have postmorten examinations been made.

In the case just reported I believe the etiology can be attributed to a vasomotor disturbance, excited by autotoxemia from intestinal putrefaction, as shown by indican in the urine, or to a disturbed metabolism. Why the palsy should occur in early springtime, and at no other period, I am unable to determine. From the history and study of this case I believe it to be a true case of migraine ophthalmoplegia, as described by Charcot.

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DISCUSSION.

Dr. William Campbell Posey, Philadelphia: Dr. Klinedinst's case is, I believe, a typical instance of that rare condition which is known as recurrent oculomotor palsy or, as Charcot termed it, "migraine ophthalmoplegia." In his case the third nerve was completely paralyzed and no other of the ocular nerves were affected. The paralysis, however, is not always limited to the third nerve; indeed in a few rare cases that nerve has escaped entirely, and the

fourth or the sixth nerve has been implicated. Ordinarily when the fourth nerve is involved, it is in association with the third. Paralysis of the sixth nerve has been observed only in a small number of cases.

While usually all the attacks occur on one side, the paralysis may occur on opposite sides at different times in the same case. Recovery of all the functions of the paralyzed muscles is usually complete after each attack.

The tendency to recur with a distinct periodicity has been observed in many of the reported cases but not in all, for in many the attacks occurred most irregularly and at very long intervals.

Lloyd, in "The Eye and Nervous System," states that the majority of the cases date their origin from childhood or even from infancy, and deSchweinitz has reported an interesting case which began in an infant one and a half years old and after repeated attacks left a permanent paralysis of the third nerve. In Dr. Klinedinst's case there was no visual aura, such as accompanies the ordinary form of migraine, nor did his patient suffer from nausea and vomiting.

Lloyd remarks upon the rarity with which anesthesia of the fifth nerve is found and says that when we consider the fact that the nerve-storm visits a large part of its fury on the fifth nerve, causing the intense headache, and that the cause, whatever it is, is sufficient to paralyze motor nerves, it seems rather remarkable that the sensory nerve is not also paralyzed. The diagnosis of typical cases of migraine ophthalmoplegia should not be difficult. It should be remembered, however, that transient loss of power in eye muscles is often seen in tabes, and that the palsies which result from brain tumors and brain syphilis are often attended with attacks of pain. The prognosis should always be guarded, and the likelihood of the palsy persisting or of more serious disease of the brain arising should always be carefully considered.

In 1905, Dr. Spiller and I reported a case of recurrent oculomotor palsy in which there were almost complete right ptosis and paresis of the inferior oblique and internal rectus muscles of the same side, which was especially interesting in regard to the migrainous attacks. This patient, a man about thirty years of age, had suffered from ordinary attacks of migraine with visual aura from his fifteenth year, but had had no attack for ten years previous to the appearance of the paresis of his ocular muscles.

The etiology and pathology of the disease has always been obscure, and in recent years there has even been a tendency to dispute

the relationship of so-called recurrent oculomotor palsy with migraine; Herbert Fisher has proposed to designate the symptom-complex as transient ophthalmoplegia externa associated with attacks of severe headache.

But few of the cases have come to autopsy. In one, Gubler found plastic exudation in the basal subarachnoid spaces, with fibrous adhesions around the origin of the third nerve, extending forwards to the chiasm. In others, postmortem examinations have shown a fibroma or chondrofibroma among the fibers of the nerve involved. Nuclear lesions have been searched for but never found.

In a second case, which I had an opportunity of studying with Dr. Spiller some time ago, the attacks of pain and the attending paralysis of the eye muscle appeared to have been excited by a postethmoidal and sphenoidal sinusitis. A case of complete third-nerve palsy, reported by Coombs-Knapp, appears to have had a similar origin.

THE OPTOMETRY QUESTION.

Dr. Louis Stricker,
CINCINNATI, OHIO.

Chairman Eye, Ear, Nose and Throat Section, Ohio State Medical Association, Dayton, O., May 8, 1912.

Members of the Section. Gentlemen:—

In formally calling this section to order, it becomes my pleasant duty to bid you welcome and to thank you for your interest in these proceedings as evidenced by your presence here. The consideration of the papers on the program and their discussion I am sure will not only be a feast of reason, but an incentive to future endeavor. Nothing stimulates interest in professional work so much, as attendance at these annual meetings. They raise the ambition of the younger and rejuvenate the flagging efforts of the older members. For those who are active and abreast of the literature of the day any attempt to recount its progress would be presumptuous on my part.

But while we assemble to confer on questions of science to alleviate the ills of mankind which ultimately conserve human energy and life, our detractors, who are many, day after day, by innuendo, questionable statements in the public press, and corrupt practises in our legislative halls, are busily engaged in a determined effort, to sway public opinion in their favor, to the detriment of the public health and our professional position in the minds of the laity, and to wrest from us vested rights secured to us under the Medical Practise Act. I refer to such fads as Osteopathy, Christian Science and Optometry; and it will only require the ingenuity of some fakir to devise some new line of treatment along some line, per example Radiography, to convulse the populace with some new cure-all.

Experience has convinced me, that as a class, physicians do not place the proper value on their medical degree, nor do they seem aware of the rights reserved to them through the Medical Practise Act, and the Licensure issued to them by the state to practise their profession. It is not a question of proficiency in one kind of work. A court of law would not permit a man to practise because he had perfected himself in every thing pertaining; let us say contracts, he must be a lawyer capable and qualified in *all* branches of law, likewise none should be permitted to take up any line of medical work—no matter how proficient—unless he shall have fulfilled all the requirements of the Medical Practise Act, i. e., shall have graduated from a reputable

medical school and shall have satisfactorily passed the State Board Medical examination and received his license to practice medicine.

Every session of our state legislature finds some of those of questionable practice and selfish motive, besieging our legislators to introduce and consider bills providing for special privileges. It is a matter of but recent history, that learned legislators gave willing ear to their importunities. I refer to the Optometry Bill from which the wisdom of our honored governor, Judson Harmon, alone saved us. But the issue is not dead, it only sleeps. At a meeting held last summer at Cedar Point, the opticians of the state, pledged their loyalty to the cause and firmly resolved to go before the legislature again and again, until they succeed in raising Optometry "to the same legal standard as medicine and dentistry." Like Col. Sellers they scent afar the possibilities of exploiting a field of 7,000,000 eyes, right here in Ohio, and gravely express their belief that those who are not already wearing glasses sooner or later will need them. Unabashed they declare that they are already raising a fund to renew the fight. What need of a fund if their cause is just. Last year they loudly declared that the doctors used money to keep the bill from being reported out of committee. Does any physician know of any physician that gave a single dollar? On the other hand every optician who belongs to the association gave from $10.00 to $25.00 to the cause and some more. The use to which this money was put is obvious, it was not all used to engage learned counsel.

The medical profession is constantly giving evidence of its deep sense of responsibility toward the public. The profession has made it as difficult as possible for men as much as to change their location from one state to another. The standard of proficiency has gradually been raised, and it is constantly growing more difficult for men to enter on the study of medicine, and when after years of preparation the student finally reaches the goal of his ambition, he finds himself confronted and in direct competition with men who either scoff at the law, or who by some short route, such as the Optometry Bill would legally accomplish—evade the real requirements of the Medical Practise Act.

These men however flourish in every community without the protection of any law and fit more glasses every day than does any oculist. Why then are they so anxious to become legalized? In the Medical Practise Act in defining what shall constitute the practise of medicine it mentions the "use of an appliance" and I venture to say, that if an optician were arrested under this provision and a test case made and carried to the supreme court, pre-

scribing of glasses except on an oculist's prescription would be held to be a violation of the act. These men are actuated by two motives; one to become recognized as pseudo-professional men thereby raising their standing in the community; the other to restrict the benefits in the hands of the favored few, thereby increasing their ability to charge larger fees. If they are really actuated by a sincere desire to become professional men why do they not study medicine? Their motives are entirely selfish. It will be a sad day for scientific medicine in the state of Ohio should they finally succeed in gaining a legal standing. Today a student must attend college for four years before he can come before the State Medical Examining Board. In most cases an internship in one of the large hospitals follows the completion of his course of study and then should the doctor desire to become an oculist a year or more must be devoted to special study; and when all this preparation is finally at an end, he finds himself in direct competition with men of no or mediocre ability who have reached the same goal by the short route of six months or a year. It is unjust to establish a double standard to do the same thing. Should the state ever legalize such a condition, in my humble judgment it would be furthering a fraud. As was pointed out by Dr. Jackson in his address at Los Angeles last year, such a condition could have but one effect; namely to discourage medical men from entering this specialty and ultimately would lead to the loss of this specialty to the medical profession.

Governor Harmon put the question to me: "Since these men are already here and concededly fitting a great many people with glasses would it not be better that they have some education rather than none as is the case today." The same reason was given by Gov. Hughes of New York, now justice on the Federal supreme bench, for signing the New York Optometry Bill. My answer was, "that in no department of science was a little knowledge so dangerous a thing as in the practice of medicine." Governor Harmon vetoed this bill, for which he deserves the gratitude of the entire medical profession. At this same meeting at Los Angeles above refered to, it was reported that an investigation made in the city of New York had disclosed sixty cases of serious eye disease leading to blindness and death overlooked by opticians in one year. And I dare say if investigation were made, similar conditions would be found to prevail in every community of the state. Not so long ago the president of this society, Dr. Bonner, reported a case in the Ohio State Medical Journal, in which the

high priest of this cult residing in the city of Dayton, repeatedly examined and refracted and changed the glasses for a young lady suffering from a brain tumor, and in which a pronounced choked disc existed until she finally drifted into Dr. Bonner's care. Not that any of us could have positively saved the life of this patient, but it might have been accomplished had she been seen early enough, the symptoms under all circumstances have been alleviated and much suffering averted. It is useless to come before such an audience as this and dwell on the relationship that exists between the eye and the brain, and the deterioration of vision which is frequently associated with pathologic conditions of the general system. But the opticians answer this argument by the broad statement that "Physics is not Physic," the sort of argument fallacious as it is, which appeals to the lay mind.

Nor has the profession been entirely free from fault, conditions which have been seized and dwelt upon by the opticians. In the medical schools of the past at least until the higher standards were established little attention was given to the specialties. Men who have attained great prominence in the practice of medicine and surgery and who stand high in the inner counsels of medical societies, have utterly failed to understand the importance of the work of the specialists and even today remain ignorant of the vast strides the specialties have made and continue to refer cases for examination to opticians. When these grave questions arise they are not in sympathy with our defense, utterly fail to grasp the situation and allow those who for the moment seemingly are the only ones affected, to work out their own salvation. This lack of unity is one of the most disquieting features of the entire problem. Two years ago quite a number of physicians and some oculists endorsed the Optometry Bill.

The ease with which men not fully qualified are enabled to enter the practice of the specialties is a feature which brings the specialties into disrepute. Sooner or later it will become necessary to establish some state regulation whereby only such men will be legally permitted to declare themselves as specialists as have passed a special state board examination and given evidence of their ability. This would be the most convincing answer to the objections raised today by the opticians, namely: That medical schools do not especially qualify men to become oculists. Colorado is the first state to answer this charge by establishing a school and giving a Degree of Doctor of Ophthalmology.

And finally we come to the most disquieting feature of the en-

tire subject, namely, the disaffection of many oculists. On the question of accepting commissions from opticians I prefer to remain silent. That the evil exists is not open to doubt. Nor can it be denied that many of the younger men depend largely on work referred to them by opticians who by reason of their advertisements have superior means of getting cases and in turn refer their difficult cases to some favored oculist. Many of these men in fear of loss of favor and the monetary loss which would ensue, remain neutral, a fact which is deeply to be deplored. They seem unable to appreciate that they are selling their birthright for a mess of pottage, and that as soon as the optician has gained his end, he will no longer have use for them. With just pride the optician will point to his license and declare that he is as capable as any oculist to refract and fit glasses, and who will then successfully say him "Nay." With insolence born of success in other states the Optical Journal and Review and Optometry (Feb. 15, 1912), issues a covert threat to those who dare to oppose them, asking, "Shall optometrists refer cases of ocular disease to oculists?"

A united profession is absolutely necessary if we are to prevail in this fight. The general profession ought never to refer a case of refraction to an optician, a not uncommon practise today and on which opticians pride themselves. I am sure no oculist would ever refuse to care for those unable to pay, and in many cases where a small fee could be obtained, it would mean just that small difference which would enable a struggling oculist to retain his self-respect and independence of mind and action. We would then present a united front rather than the half-hearted co-operation which suddenly developes at the eleventh hour. Surely it is as true today as when Patrick Henry said it—"The price of liberty is eternal vigilance."

Finally, the public needs understand the subject. To many there is no known difference between an oculist and an optician, and many do not know that an oculist is a physician. Opticians announce in the daily press in bold type—"Some people call on two parties, one to prescribe and the other to make the glasses; two costs and a *division of responsibility.*" A rather convincing argument for the layman in favor of thrift, of the penny wise and pound foolish kind, but then how is the poor ignorant public going to know?

Gentlemen, it is high time that the public did know, that the public be enlightened as to what the real difference between the oculist and an optician is; what the practice of medicine really

means; what the profession has done, and what it is doing to prevent sickness, suffering and death. Nothing is more needed than a publicity campaign such as has been inaugurated by the state society this year and to bring home to the masses, by public lectures before civic organizations, church societies and mother's clubs, the deeds accomplished and the great factor the medical profession has become. has been along preventative lines, in conserving health, life and incidentally eyesight and preventing blindness. The lay mind will then awaken to a more rational understanding of the aims of medical men and they will co-operate rather than oppose measures which can only redound to the wellfare of all the people.

Those who are alive to the indications of the times observe that this nation is passing through a period of social unrest. In every community there has gradually developed the social worker, not peculiar to any form of religion, not a visionary, but a practical doer of things, busily at work among the needy, the fallen and the oppressed. And no matter from whatever angle the subject is attacked, the never failing answer is, that a very large percentage of crime, poverty and dependence is directly traceable to preventable disease and death. It is loudly proclaimed from the house tops "that the health of the people is the nation's greatest asset." Last October before the Charities and Corrections of the state, held at Toledo, Mr. Edward T. Devine, the editor of *The Survey,* in his address gravely admonished his hearers to study the *death rate,* as the great indicator and test for the character and need of their service. He said:

> The death rate is very conservative institution, handed down to us from our remote ancestors, older than constitutions and charters, relentless as fate, bearing a smiling aspect towards such measures as have aroused the enthusiasm of social workers, frowning upon destitution and neglect and exploitation—with never an error of judgment, never a concession to good intentions and never a trace of maudlin sympathy. The death rate pronounces judgment upon congestion of population, upon unsanitary dwellings whether in the tenements of the great metropolis, in the alleys of smaller towns, in construction camps or on the isolated contaminated clearing. It makes way cheerfully for health and longevity in homes that are clean, that admit the sunshine and the fresh air, and the disinfectant when the necessity arises. The death rate points its finger unerringly at the infected house, the infected milk can, the infected well, the infected dairy, the infected meat market, the infected oyster bed, the infected drug store, the infected saloon, and the cursedly infected house of prostitution. The death rate sings aloud joyously in its movement towards zero, at the vigorous efficient, non-partisan health department, at the modernized co-operative overseer of the poor, at the conscientious landlord

and the reasonable tenant, at the certified dairy and the protected water supply, at meat, and flour and fruit which are sound and wholesome in their origins, safeguarded in market and in transit, and prepared for the table in sensible and scientific fashion. The death rate has a good word for sanatoria for incipient consumptives, for colonies for feeble-minded and epileptics, for early attention to cases of nervous and mental disturbance. The death rate is a wonderful temperance agitator, absolutely fanatical in its preference for total abstinence and pronouncing a sorrowful curse to the third and fourth generation upon drug and alcoholic inebriates. The death rate raises its warning voice against the dirt poisoning of the milk on which infants are to be fed, and even argues with a persuasive voice in favor of natural maternal nursing. It pleads for the instruction of mothers in the care of infants for scrupulous attention to obstructions to breathing, decayed teeth, curved spines, defective eyesight and other physical defects in growing children, and it denounces child labor. The death rate tells us not only deaths. That would be much, but it tells by inference also of disease. If there is a death rate from typhoid, we may be sure that there are not only deaths and the sickness preceding these deaths, but many cases of illness besides, for not all typhoid results in death. Some diseases, like pneumonia and meningitis, have a high mortality and death may come quickly on the attack. Other diseases, like rheumatism, kill at long range and it is difficult to disentangle them from the so-called end diseases which account for the death in the mortality tables—yet in a large way there is always, of course, a relation between death rate and the prevalence of disease, and to the social worker the disease is even more important than death. Altogether the death rate deserves well of mankind.

Great as is this tribute to the medical profession, it does not encompass all that the profession has accomplished in this vast field. Nor will this statement elicit surprise among medical men. But it does show that the social workers' program is in a large measure a recital of things indicated, things recognized, things accomplished by reason of medical research and knowledge attained and demonstrated to be of vast economic value to mankind. Health is being recognized as the very keystone to the arch of social progress and the prime requisite to the uplift of the human race. At no time in the history of the world, has the physician occupied so prominent, so important a place as he does today by reason of his superior knowledge and ability to combat disease and prevent epidemics, to save life and conserve man's energies, which are translated into happiness and wealth.

These facts once recognized, the medical profession will be held in greater esteem, nor will it constantly be called upon to protect itself against the ever recurring onslaughts of faddists and pseudo-medical brigands. The public can only be aroused to the importance of this subject by education, and in turn our legislators will

only give heed when their constituents demand it. Unity of purpose is absolutely essential if we hope to prevail in this cause, nor should we seek to find the mote in our neighbor's eye, until we pluck out that in our own.

I would therefore bid you pause and consider what it is, that the Medical Degree and Licensure to practise reserves to each and every one of us; nor look lightly upon nor underestimate the attitude and the spirit which underlies this movement of the opticians. The attitude of the medical profession toward its members, alone should be evidence sufficient—at least so far as the public is concerned, that as a whole we have a deep sense of appreciation of our responsibility to safeguard life and health; whereas opticians are moved by a selfish motive to restrict their numbers for personal agrandizement and gain.

THE AXIS, OBJECTIVELY IN RETINOSCOPY.

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Any means aiding in the objective determination of the axis would seem in order, appreciating the increasing tendency among examiners to attach as much importance and weight to their own findings as to those secured by subjective assistance. Such being the case, the prescription is written only after due consideration of both findings, not of the subjective alone. Although, as Jackson points out, the test card examination is the last court of appeal, this seems to relate more particularly to the quantitive element of the correction than to the details of axis and so on.

That amount of assistance rendered by the examined eye; or, to be more specific, the average intelligence, does not always measure up to that degree of accuracy desired alike by the examined and examiner. In fact, the burden of attaining this very often rests with the refractionist. Hence the elaboration of objective means of examination as well as the invention of such optical instruments as will aid the individual under examination to give material assistance—scientific assistance through the instruments used.

To arrive, however, at the object of this note, it may be said that the objective means, to be here considered, are simply a refinement in retinoscopy, nothing new, perhaps, as, so far as I am aware, the literature may or may not contain reference to the same details.

The rules laid down for the determination of the axis with the retinoscope are to the effect, generally, that the band of light indicates the direction for the correcting cylinder. These rules may be qualified, meaning that the direction is so variable and elusive during the examination that as an index it is not entirely to be relied upon. A variation as much as thirty degrees may occur in the course of an examination, making it the problem to find the fixed position for the cylinder, which position alone is the correct one. When the eye is artifically made spherical, the cylinder used, as already remarked, has a fixed position, and the shadow shows all the characteristics of a spherical one. Using the plain mirror, enough of the sphere is taken out of the correction so that at one meter a shadow of about .50 or .75 D. in a plus case moves "with" the mirror in a circular, vertical or horizontal direction. If the cylinder is altered or in a faulty position, of course the shadow becomes imperfect; for instance, in a case requiring a+2 ax. 90, this cylinder, when turned to the nasal side will very soon cause

an ill-defined band to appear on the temporal side, and vice-versa when turned temporally. The shadow, consequently, is no longer that observed in a spherical eye; instead of being round, clear-cut and freely movable in every direction, and parallel with the movement of the plain mirror, it moves obliquely with it, as observed in a case of compound astigmatism at odd angles. In such a case, the direction of the cylinder in the sphero-cylindric equivalent of the cross cylinders at odd angles must also be fixed in order to produce a satisfactory or spherical shadow. The transposition is accordingly reached by retinoscopy instead of mathematically. To approximate to accuracy, the exact position of the cylinder is of essential importance.

As for the practical application of the test, which is all-controlling, one may have reason to believe, to take the supposed case quoted, that the +2 cylinder should be at axis 90, each meridian having by turn been tested by retinoscopy and verified by subjective examination. To prove the case objectively, the cylinder is first placed at 90 and then turned nasally and temporally until a visible band appears in the respective directions opposite to the movements and new positions of the cylinder. Noting in each instance how far the cylinder is turned in one way and then the other in order to produce the respective bands, the position midway between the extreme of each movement, is the correct one—as in the procedure of swinging the cylinder in the subjective test. If turned nasally 10 degrees and the same temporally, the result, of course, would be 90 or vertical. When the cylinder is more than one diopter it takes very little movement to create the new band; in smaller cylinders, of course, the excursion must be considerable. The practical usefulness of this test ceases unfortunately when the cylinder is very small, or, at least, until one becomes practised in the detection of the strictly spherical shadow. J. Herbert Claiborne very recently pointed out regarding the truly spherical shadow, that when the (concave) mirror is given a circular movement a peripheral or second shadow is seen "apparently to chase the other around"—that there is no skipping across the visible or invisible band, as in the presence of astigmatism.

Objective determination of the axis, if this means can be perfected, may have a number of advantages:

In the refraction of the illiterate, or indeed any class unable to give satisfactory subjective assistance.

To check up the subjective test with regard to axis.

Where, as others have written, the axes for near and far differ,

the pair of axes, as objectively determined when the patient's eyes are directed toward the examiner's forehead, may be a comfortable compromise between the near and far axes.

In those cases, showing after subjective test, that the position of the cylinder, when one eye alone is tested, is not the same as when the two eyes are in use together. For instance, the right eye may seem to require a cylinder at axis 90 when tested alone, the left at 75, but uncovering both eyes together, the cylinders may be favorably placed at 95 and 85 respectively; and in these latter positions, the shadow of each eye, both being uncovered, may seem a perfect spherical shadow, while with the cylinders at 90 and 75, not so.

This small detail in retinoscopy, it is hoped, may assist in the fitting of each individual eye, and, more important, aid in the selection of those lenses which take into account such changes in the refraction as may take place incidentially to the act of binocular vision.

GUARDED PROGNOSIS IN INJURIES TO THE CORNEA.

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Read before the Eye, Ear, Nose and Throat Section, Ohio State Medical Association, 1912.

The great and varied number of injuries to which the cornea is exposed makes us more cautious in our methods of examination and also more careful in the prognosis as to vision. Experience in ophthalmic practice has taught us to realize how often we have met with apparently trivial injuries which have resulted seriously to sight, and also destructive pathological changes. Again how apparently severe injuries to the cornea and its adnexa have resulted in most favorable results. Meeting with these conditions has prompted me to choose this subject.

How often do we see patients who have binocular vision, and then through some corneal injury this becomes monocular. The patient does not realize the seriousness of this, until some injury or inflammation occurs in the sound eye. A patient whose occupation does not call for binocular vision gives this but little thought, as shown in the following case: Young man, 23 years of age. Occupation, draftsman. Injury to his right eye which resulted in loss of vission. Did not know left eye was defective. Examination showed a clear case of amblyopia exanopsia. Vision 15/200. Jæger No. 5. Glasses no improvement. Treatment of various kinds for two years with absolutely no improvement in vision. Does this not teach us the value of making a visual test of both eyes on the date of examination and also to do our utmost to improve the standard of vision in an injured eye, no matter how trivial the injury may appear. This necessitates our following up the case until we are satisfied that we have reached the limit of improvement, discharging our patient, warning him of the probable outcome, should any pathological changes take place in the sound eye.

Numerous unrecognized foreign bodies and slight abrasions are overlooked, and treated for conjunctivitis, until focal illumination and fluorescin are used. A prognosis cannot be made until repair of tissue has taken place, as we are unable to state how much interference with vision will be produced by scar tissue, causing astigmatism or interference in transmission of rays.

The great resisting power of the cornea is an established physiological fact and at times we are astonished to know how seriously the cornea may be injured, and repair still take place without any

great damage. Again, how an apparently trivial injury may result disastrously, as shown in the following case: Young man, age 22 years. Apparently in good health; habits bad, i. e., cigarette smoker and liberal user of alcoholic stimulants. A hot cinder lodged in cornea of left eye which was easily removed. Treated antiseptically, irritation and inflammation persisted. Patient returned after third day, when the condition was diagnosed, simple conjunctivitis. On the tenth day he again returned with apparently no improvement, but an increased congestion in the mucous membrane of the upper lid and a small nodular elevation; still no discharge of pus. On the thirteenth day the nodule broke discharging a creamy pus, which under the microscope showed a most virulent form of gonoccucus. Further examination revealed an acute case of gonorrhea. The infection infiltrated the entire eyeball, starting in the deeper tissue; the final result can easily be pictured without further description. This was without doubt a case of metastatic ophthalmia, excited by the trauma. A favorable prognosis in this case was not only humiliating but most embarrassing.

Traumatism in an individual of tubercular or syphilitic predisposition may show itself in a circulatory metabolic change, same as in any infectious disease, due to the lowered resistance of the cornea, following a trauma. Mohr, of Breslau, reports two cases of traumatic keratitis, in which one showed positive Wasserman reaction, and the other a negative. The probable damage of this condition we are all familiar with.

A foreign body may be retained in the cornea indefinitely providing it is aseptic, and tolerance has been established. The shape will also have something to do with retention, a smooth body is less irritating, but must be inert. Weak chemical substances, such as iron, copper, glass and stone, may cause but slight local exudation and become encapsulated. Contraction of the newly formed tissue, with further changes in the anatomical relations of the structures, may terminate in opacities and discoloration, thus interfering with vision and even result in blindness.

Erosions and abrasions of the cornea usually result in the solution of continuity of the anterior epithelial layer, in which the elastic layer is laid bare, thus exposing the sensory nerves. Such conditions are accompanied by distressing irritative symptoms, as photophobia, lachrymation and pain. These symptoms may persist for 48 hours or more, the patient claiming that he still has a foreign body in the cornea. These symptoms do not subside un-

til the epithelium has been replaced. As a rule they do not involve Bowman's membrane or the substantia propria and heal quickly. Prognosis good.

Direct impact injuries to the cornea with little force, or those produced by various foreign bodies or substances, regenerate within 24 hours, unless complicated by infection, which may result in corneal ulceration, abscesses and even panophthalmitis.

Wounds of the cornea which extend deeper, and still are not perforating, will involve the lamina elastica anterior, into the substantia propria and may even go into the lamina elastica posterior. The prognosis of such a wound is always of serious consideration to the visual acuity. This is again based on the degree and nature of the wound, whether it is clean-cut or lacerated, and whether it is located in the center, or at the marginal edge of the cornea. A central scar is sure to disturb vision by its presence, and a marginal scar will produce its deleterious effect by traction of the scar tissue, causing astigmatism. These conditions may not present themselves for weeks or even months following the injury. A striking example of this was in a railway brakeman who received a small clean cut 3 mm. long, in the lower quadrant of the cornea, extending to the posterior layer. Primary union took place and patient was discharged after two weeks, with vision 20/20. Three months later, patient was sent back by the railroad company for defective vision in this eye, vision 20/60. Six months later, vision 20/200. Examination revealed no pathological change except a light linear scar. His vision continued to fail until it reached 5/200, and with a—2.00 S. ::—3.25 cyl. av. 15 was 20/60. The point to emphasize in this case is the favorable report at the time of his discharge, and the damaging result which followed, without reasonable explanation.

Again, we must be guarded in the dangerous flap wounds where the flap almost immediately falls back into place, and heals quickly with a slight cloudiness, which gradually disappears. Whereas, should a small particle of septic material be retained, disastrous results might be looked for.

In contused wounds of the cornea we invariably find a cloudy, deep contusion opacity, which Wagemann claims, is due to an edema, and must be considered a swelling phenomena, of which the lesions of the endothelium are perhaps the chief cause. Sight is invariably reduced, and should a hemorrhage occur, it may result in blindness. Pain is usually absent, and the soreness which

accompanies such injuries, is due to bruising and consequent destruction of the sensitive nerve endings.

The cornea in some cases clears with defective sight or a grayish opacity remaining. A report of such a case is the following: Injury to the cornea by flying particle of stone in blasting, hyperemia slight. No pain, but soreness. Round peppery opacity in deeper layers of cornea. Otherwise no pathological changes. Opacity persistent. Treatment of no avail. Vision reduced to counting fingers.

Case II: Contused injury to cornea by fiying bolt. Intense hyperemia, no pain, but soreness. Light cloudiness of cornea, which cleared up in nine days. No pathological changes evident. Vision absolutely nil. Kept patient under observation for a year with no improvement in vision. We may recognize in this case a possibility of hysterical amblyopia. This form of corneal injury will also aid us in the etiology of child-birth injuries by the use of forceps.

Perforating wounds which completely penetrate all the layers of the cornea without retention of a foreign body are always serious. The prognosis depends on the complications, such as prolapse iris, rupture of the lense capsule or the deeper structures, together with the inflammatory involvement and infection. A simple rupture of the corneal tissue may heal with almost perfect restoration of vision.

We may now turn to the class of cases in which the cornea has been injured by burns or cauterization. Superficial erosions are usually replaced within 24 to 48 hours, whereas the deeper burns become opaque and look like ground glass. In the more severe burns it resembles porcelain. In burns we generally have a line of demarkation and the necrotic area is cast off, leaving a corneal ulcer, healing with scar formation, which may also result in ectasia or corneal stapyhloma. On account of their interference with vision we may class all corneal burns except the most superficial as serious. Should the circum-corneal zone be involved in the burn, the nutrient blood vessels are cut off and cause sloughing of the entire cornea.

Guillery explains the peculiar changes in the cornea, caused by acids, as being due to the fixation of the corneal tissue, similiar to the action of acids on organic tissue, when used for histological purposes. There is primarily an opacity due to the action of the acid on the mucoid substance which coagulated. Later this is dissolved, causing a clearing which lasts for several days or even

weeks. This suspicious clearness is followed by secondary opacity caused by an involvement of the endothelium of Decemet's membrane, sometimes resulting in ectasia of the cornea. Such a cornea is necrotic and without reaction. Lime also has a peculiar affinity for the corneal tissue, producing a permanent opacity, which renders the prognosis for sight unfavorable. Ammonia is another chemical, which proves disastrous if introduced into the eye. The report of the following case will clearly illustrate this fact. Mr. M. B. on December 10, 1910, while playing with a companion, accidentally had a few drops of ammonia water splashed into his right eye. The eye was immediately washed out with vinegar and cold compresses applied. The next day he was brought to my office. Examination showed but very little irritation, no photophobia and no pain. There was slight haziness of the cornea, which seemed confined to the superficial epithelium. On the third day the conjunctiva of the lower lid in which place the ammonia evidently lodged, an dalso the lower bulbar conjunctiva was studded with small hemorrhagic spots, which also seemed to include the scleral tissue. This condition spread over the entire bulbar conjunctiva and upper lid. On the seventh day the cornea showed signs of infiltration which extended throughout the entire cornea. At the same time there was considerable edema of the conjunctiva, which crowded over onto the cornea. This condition existed for ten days, which repeated molecular hemmorrhages. At the end of the third week these symptoms gradually subsided, leaving a boggy mass of tissue covering the cornea. At the end of the third month, cicatrices had formed throughout the conjunctiva of the lids and bulb, leaving a dense white opaque mass in the cornea. At no time was there any pain or active inflammation, but simply inflammatory exudate with cicatricial formation due to a slow but certain active irritant, formed by the chemical combination of ammonia with the eye fluid, or its action on the tissues or both. The patient was robust, healthy and of good habits. Very few cases are on record and most cases reported resulted in blindness.

The deleterious action of ammonia in the eye is explained by some authors as being due to its affinity for water, which is extracted from the tissues and the formation of an albuminate; thus the molecular structure of the epithelium is destroyed, so that it becomes necrotic. This dead tissue acts as a foreign body causing an inflammatory irritation of the deeper tissues.

Stieren claims ammonia causes an occlusion of the canal of Schlemm and spaces of Fontana, thus bringing about this condition

by interference with nutrition. Should this be so, we would expect an increase of tension, which was not present, nor was there any pain.

Details in the pathological changes or treatment of corneal injuries is not the sense of this paper but merely to impress that a prognosis in corneal injuries, even though slight, should be careful and guarded.

THE INTRACAPSULAR CATARACT OPERATION FROM THE VIEWPOINT OF AN ASSISTANT.

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This is a much told tale, retold. I hope it will serve to open a discussion which may prove of some benefit to all. I shall neither quote nor cite authorities, and I trust you will pardon the frequent use of the personal pronoun, as this is purely a personal paper, intended only to be an expression of some impressions from my own experience and observation. It will not be long.

The Smith intracapsular operation is distinctive in cataract work in that an assistant is a necessity. His importance during the operation is a matter of varied estimates. Some operators hold his function to be almost as important as that of the operator himself. Howsoever this may be, he is a necessity.

His relation to the operator should be that of a second pair of hands and eyes. He should know the mind and manner of the operator so intimately that the four hands work as though directed by one mind. Impossible, you say; well, perhaps, and yet that should be the end aimed at. If this relationship be approximately attained his service in certain complications is invaluable.

The preparation of the patient may be left entirely to the trained assistant. The toilet and anesthetic and mental preparation of the patient should be made by one person, either the operator or the assistant.

All patients should be mentally prepared. Operator and assistant should have a thorough understanding as to what ordinarily will be expected of the patient, in order that he may be instructed how and when to act. That he may not become confused or alarmed or nervous during the operation, there should be no talking or disturbance in the room, except what is absolutely necessary to direct the patient's actions or to quiet his disturbed mind. He hears every word said and frequently will believe that what is said is meant especially for his ears. He may become confused and will not do his share of the work so well as he might. I believe not an unnecessary word should be spoken.

I do not believe that clinics where more than two or three spectators are present should be held, and these should always be in the operator's own operating rooms. The patient's welfare is under all circumstances the first consideration, and you who have operated in unfamiliar surroundings, with strange instruments, etc., know that, to say the least, the tension under which you work is

very much increased and in just that far the hazard to the patient is increased.

The mental preparation of the patients varies as their dispositions vary. The assistant should try to know his patient's attitude and nervous condition. With some a word of assurance is all that is required. With others a detailed description, including practice in the movements of the eyeball, seems advisable. With some patients a simple request to look gently down, will produce a spastic contraction of the inferior rectus of sufficient force to endanger the integrity of eye. A few words of instruction and trials at obeying requests of this kind will nearly always give him confidence and possibly avoid a serious complication.

The usual preparation of the site of operation is made by the nurse before the patient is brought to the operating room. The anesthetic is given by the assistant. A four per cent solution of cocaine in my observation has proved most effective, when given two drops in the eye four times within fifteen minutes. Holocain in a one per cent solution used similarly has not given as satisfactory anesthesia as cocaine. After the fifteen minutes the anesthesia is complete. The conjunctival sac is thoroughly washed with sterile water, a two per cent boracic acid solution or a normal salt solution. A drop of adrenalin may be used at this time with seemingly good effect.

All is now ready for the operation. The positions of the operator and assistant depend on whether the operator is ambidextrous and which eye is operated upon if he is not ambidextrous. If ambidextrous his position for either eye, during the incision and iridectomy is at the top of the patient's head while the assistant is at the left. If not ambidextrous, for the right eye the positions will be as above. But for the left eye they are reversed.

If the speculum is used the assistant has no special duty during the incision and iridectomy. My belief is, however, that it is always safest to use either the fenestrated Fisher lid elevator or the Smith hook during these two steps. I have seen the patient squeeze so suddenly and so hard just the instant the incision was finished, that he threw the lens in its capsule out over his head onto the floor. I believe the danger of such a complication very much lessened if the lid elevator or hook is used.

The incision should be large, large enough to permit the delivery of the lens in its capsule with ease. The knife in the puncture and the counter-puncture enters and emerges about one and one-half millimeters to the outer side of the sclero-corneal margin,

with its back passing over the center of the pupil. The incision in a majority of the cases I have observed could be finished with the one naso-frontal sweep of the knife. The depth of the eye in the socket has much to do in determining whether this can be done or not. The incision should be wholly corneal and should be as nearly at right angle to the surfaces of the cornea as possible. This does not make a flap, precludes hemorrhage, theoretically lessens astigmatism, and especially favors healing by first intention. A small flap, conjunctival or epithelial, has been the most frequent cause of delayed healing in those cases coming under my observation. The edges of the corneal wound seem not to coapt properly and union by first intention does not occur, delayed healing with all its annoyances takes place and disastrous results may follow.

An iridectomy should be made, not large but quite well back toward the ciliary margin, this does not bind the lens very greatly in its exit. I am persuaded, also that a preliminary iridectomy is not wise in this operation, for the reason that the edges of the iridal wound may become adhered to the endothelial edges of the incision, or to the capsule itself, and thus seriously hinder the accouchment of the lenticular body. Also, the iridal wound heals and the cicatricial edges are not so elastic as the non-cicatrized wound, which makes the delivery more difficult. Again it requires a second operation which violates one of the principal claims of superiority for the intracapsular operation.

The assistant during both the incision and iridectomy should be in readiness to act positively and with dispatch. Perhaps it is best for him at all times to have as good control as possible of the superior musculature. With his thumb on the brow and the palm flat on the forehead he will have fairly good control of the frontalis and the levator palpebrae. By this means he can offset much of the effect of the patient's attempts to squeeze.

The instruments used up to this point do not differ materially from those ordinarily used in the capsulotomy method. But from this on the change is radical. I shall not take your time to describe the instruments, most of you are fully acquainted with them. They are the lid hook, the expression hook and the spud.

The assistant during this and the following steps of the operation always stands at the patient's left. He takes the lid hook in his right hand, holding it between the thumb and forefinger. The other three fingers of that hand are placed against the brow and with an upward pressure keep the frontalis and levator under control and relieve the globe of some pressure from above. The lid

hook is held almost perpendicular to the plane of the face, lifting with sufficient force only to hold the lid well away from the eye and to control the obicularis. This force is not great and the assistant should be careful not to cause the patient pain by means of it. However, it is essential that the lid be kept taut in order that if the patient should suddenly attempt to squeeze he will do no harm. There are patients who will contract so strongly and continuously as to tire the thumb and forefinger of the assistant very greatly. The lower lid is retracted with the thumb or forefinger of the left hand.

Having the lids and musculature thus under control, there is but one source of danger from the patient himself, but this is a most fruitful source and is by far the most frequent cause of loss of vitreous. I refer to the contraction of the inferior rectus, over which the patient alone has control. It seems to me that if there were some means of control of this muscle, that loss of vitreous would be practically nil, and the attention the wound needs after the delivery of the lens would be fraught with no danger.

The assistant must see the field of operation and do all he can to give the operator the most perfect view possible. By slipping the hook along the edge of the lid toward one canthus or the other, or by slightly turning it he can nearly always keep the entire cornea, at least, within the view of the operator.

The operator holding the delivery hook in his right hand and the spud in the left hand, places the ball of the delivery hook on the cornea immediately below the center of the pupil. He may or may not place the entire arm of the hook flat on the cornea with the ball in the position just stated and the angle at the lower corneal margin. This position, in my judgment, has given better control of the progress of the lens.

Pressure is first made directly backward toward the posterior pole of the eye-ball, with just sufficient force to loosen the zonular attachment. As soon as the lens presents in the wound the direction of the pressure is changed as to assist the exit of the lens through the incision. If it slide straight out the hook should be in position to push it. If it be a "tumbler," that is, if it turns over so that the lower edge is delivered first, the pressure must be downward toward the cheek until the point of the hook is under the lower edge of the lens, the cornea in this case will quite frequently be folded back on itself. The pressure used is never greater than that used in delivering the nuceus in the capsolutory

method of operating, although to the onlooker it appears frightful at times.

It is just at this stage of the operation that the assistant is an absolute necessity. Just as the lens is passing through the incision he should be most careful to relieve all pressure possible from the globe by keeping the brow well up and the lids under firm control. The lens usually hangs in the wound by a few zonular fibers, these are broken by a slight tilting motion from edge to edge with the hook in the hand of the operator. During this manipulation the assistant's control should remain constant. The lens delivered, replacing of the pillars of the iris and smoothing out and coaptation of the edges of the wound follow. Here also the assistant must be ever on the alert to give the operator the best possible view and to avert a loss of vitreous. His importance is greatest during the delivery and final toilet. Just following the delivery I frequently have seen the patient slightly contract the inferior rectus and the vitreous body present in the wound quite prominently. By strong retraction of the brow upward it is quite frequently possible to overcome this and the vitreous sinks back into its normal position.

The operation finished, the lid is gently freed from the elevator hook, the eye is closed and bandaged and its future usefulness is in great measure in the hands of the patient himself.

Just a word as to the results of the operation. The one aim and end desired is vision. To my mind there is seldom any other excuse for a cataract operation. The vision for those patients whom it has been my privilege to know as operator and assistant has ranged from twenty-tenths through all stages to nil, but with an average for the whole number a little better than by the capsulatory method.

REVOLVER BULLET IN THE CHIASMA—CONSECUTIVE BINOCULAR BLINDNESS.

Dr. J. N. Roy.

Ophthalmologist to the Hotel-Dieu of Montreal, Canada.

In perusing medical literature on accidents to the eyes caused by revolver or gun shots, we find a large number of most interesting observations. Modern war, in which firearms play the principal role, has furnished us with a vast field of study, and since 1870 very important and complete works have been written on this subject. The patient whose history we are about to relate received in his left temple a revolver bullet which lodged in the chiasma and which was the cause of permanent binocular blindness. As the X-Ray examination permitted us to localize this foreign body in an indisputable manner, and as we have been unable in our bibliographic researches to find a similar case, we believe that this observation is unique of its kind.

Observation: Mr. A. B., aged 75 years, was brought to us at the Hotel Dieu on May 31st, 1910, to consult us with regard to his eyes. The previous evening at 10 o'clock, while crossing one of the city parks, he received in his left temple a revolver bullet, which caused blindness. He did not lose consciousness, and after wandering for a certain time, he was conducted to the hospital by a policeman. He naturally passed a bad night, and when we saw the patient the next morning he complained of cephalalgy, of bleeding at the nose, of spitting blood and of no longer seeing clearly.

On examination we noted a hole in the left temple of about 4 mm. in diameter. This cavity was three centimeters from the outer canthus and 2 mm. below the horizontal meridian.

The skin of the temple, of the cheek and of the eyelids on the left side was tattooed with powder grains.

There was quite considerable palpebral oedema and very pronounced exophthalmos of the left eye. Pericorneal hemorrhage and slight chemosis.

An old ulceration of the cornea had left a scar on the external part, near the limbus. The corneal sensibility, the anterior chamber and the ocular tension were in normal condition.

The iris, which did not react to light, was dilated, and we noticed a posterior synechia, the remains of an inflammation of rheumatic nature, dating back many years.

The ophthalmoscopic examination permitted us to observe very considerable chorioido-retinal hemorrhage, especially on the temporal side. There was also a hemorrhage into the vitreous humour.

The colour of the disc was normal.

The patient counted fingers at a distance of 0.20 centimetres.

If the examination of the left eye was interesting the right also presented unusual features. In fact, we found a paralysis of the third nerve accompanied by ptosis.

The pupil was dilated, and did not contract to light.

There was no perception of light.

The optic nerve was normal in appearance, as well as the other parts of the eyeball.

Anterior rhinoscopy permitted us to note a slight rhinitis on both sides, and blood in the left nostril. On examining the pharynx, we found a dry pharyngitis, and posterior rhinoscopy showed blood still coming from the left choana. There was no anosmia.

The two maxillary sinuses were equally transparent to the diaphanoscope, and the right pupil was luminous. The left pupil was obscure, and this phenomenon is explained, not by a sinusitis or by blood in the corresponding antrum of Highmore, but by hemorrhage of the vitreous.

Normal condition of both ears.

The sensibility of the skin of the face on both sides was normal.

Nothing at all of interest from the point of view of heredity.

As regards the patient's own history apart from the usual children's diseases, he claimed to be subject to rheumatism, and to have had an ulceration of the left cornea, also an iritis of a rheumatic nature.

No tuberculosis or syphilis.

Normal urine.

In the presence of rather classic ocular symptoms, it was easy for us to localize the exact spot where the foreign body was to be found. Nevertheless, we asked our friend, Dr. Desloges, radiologist of the Hotel Dieu, to be good enough to make an X-Ray examination. Needless to say, we were not tempted to introduce a probe into the wound to discover its condition, for these manoeuvers are always to be condemned, and sometimes produce unfortunate results. In the present case we would have risked especially increasing the lesion of the optic nerve, as well as the retro-bulbar hemorrhage. After having placed on the head a certain number of wires, to serve as guides, the patient was radiographed in three different positions. These three negatives permitted us to locate positively the bullet in the chiasma.

As our patient had no alarming symptoms from a vital point of

view, and consequently nothing compelled the removal of the foreign body, we prescribed the following treatment:

Ice kept continually on the left eye, a dressing on the temple, boric lotion, borico-mentholated salve for the nose, an antiseptic gargle, light diet, and calcium sulphide pills, of 0.07 centigr. each, one pill three times during each twenty-four hours. We were pleased to note in the days following that the patient had no temperature, that the headache was less severe, that he no longer spat blood, and had no more epistaxis, and that the palpebral oedema and the chemosis diminished rapidly.

June 7th.—The ophthalmoscopic examination of the left eye allowed us to make the same observations as the day after the accident, and the sight was the same. The disc of the right eye was still normal as regards colour, and there was no perception of light. We discontinued the calcium sulphide pills and prescribed potassium iodide in doses of one gram three times a day.

June 14th.—The temporal wound was healed. No temperature. The headache, the palpebral oedema and the chemosis of the left eye have disappeared. The ocular conjunctiva was growing pale and the exophthalmos had diminished. The ophthalmic appearance of the fundus was the same as before. The eye-sight was not any better. In the left eye the ptosis and the other paralyses of the third nerve were improving. The disc was becoming pale. We prescribed a series of injections at the temple of sulphate of strychnine, ten drops of a 1% solution, once a day.

June 28th.—The pericorneal hemorrhage of the left eye had disappeared. The chorioido-retinal hemorrhage appeared to have become absorbed to a small extent. The nasal half of the disc was whiter than the temporal half. The patient still counted fingers at a distance of 0.20 centimetres. As the vitreous opacities had now partially cleared up, we measured the field of vision. We then noted temporal hemianopsia, with numerous scotomata in the nasal portion. The field of vision was naturally contracted since the patient could only see at a short distance. As for the right eye, the ptosis and the paralysis of the third nerve had entirely disappeared and the disc continued to atrophy. The blood vessels of the retina appeared to be diminishing in size.

July 26th.—The chorioido-retinal hemorrhages and those of the vitreous humour of the left eye were being gradually absorbed. The disc was pale, especially in the nasal half. The vision was a little better since the patient could count fingers at a distance of 0.30 centimetres. On the right, the atrophy continually increases.

The patient then left the city, and we were ten months without seeing him.

May 20th, 1911.—Almost a year has passed since the accident. Since leaving the hospital the patient's general health has been excellent. He has never suffered from any general symptoms, such as headache, nervousness, insomnia, loss of memory. On examination of the left eye we note that the pupil is a little more dilated than is normal, and in an irregular manner, it reacts very slightly to light. The crystalline lens is transparent, and there are still flakes in the vitreous humour. The supero-external half of the interior of the eyeball shows in certain places spots of chorioido-retinal atrophy. In the infero-external section, near the disc, there is an almost symmetrical area of proliferating retinitis. This measures about two disc-diametres in its different axes. There is no chorioidal laceration. We note evidences of the pigmentary type of chorioido-retinitis and deposits of pigment around the areas of atrophy and of the cicatrix left by the proliferating retinitis. The nasal side of the optic nerve is atrophied, and the temporal half slightly discoloured. The blood vessels of the retina are of normal calibre. The patient can always count fingers at a distance of 0.30 centimetres, but it is impossible for him to recognize colours. His visual half-field is narrowed. As to the right eye, the pupil is dilated, and the optic nerve entirely atrophied. The retinal arteries and veins are filiform, and the fundus has grown pale. There is now no paralysis of the third nerve.

We saw our patient again in March, 1912, and his condition was the same. He still counts fingers at a distance of 0.30 centimetres, and states that his health is excellent. Apart from the scar formed by the proliferating retinitis, which has diminished a little in volume, we note nothing in the left or right eye that differs from what we found in our last examination and which is worth describing.

If we now analyze the phenomena observed in our patient we see that the bullet produced a series of most classic symptoms. In the first place, in order to find from what distance the bullet was fired, we experimented with revolvers of different makes, and with blotting paper wet and dry. In comparing the incrustation of powder on the paper and on the skin of the temple, of the cheek and of the eyelids, we found that the revolver was fired at a distance of 0.25 or 0.30 centimetres from the wounded man. Moreover, we can add that from the cutaneous pigmentation, the cartridge was loaded with black powder. The aspect of the wound and the X-Ray ap-

pearance of the foreign body in the chiasma lead us to conclude that the bullet was from a 22 calibre revolver, corresponding to a diameter of 5 mm. As our patient is not left-handed, we were almost certain that we were not dealing with an attempt at suicide, as from the distance from which the shot was fired it would certainly have required a great deal of accuracy for things to have occurred as they did.

The bullet in crossing the left orbital cavity must have injured the vaginal sheat, and perhaps a part of the optic nerve, for the chorioido-retinal and vitreous hemorrhage lead us to accept this hypothesis as being the most probable. We do not believe that the retro-bulbar hemorrhage which caused the exophthalmos was of itself sufficient by compression of the globe to cause all the pathologic lesions of the fundus.

On entering the chiasma the bullet perforated the left posterior ethmoidal cells and produced epistaxis on this side and also caused the spitting of blood.

After completing its course, the foreign body was stopped in the chiasma, and was the cause of the loss of vision in the right eye, and of the left temporal hemianopsia in one of the two following ways: The bullet had entirely destroyed the right optic nerve and the decussating fibres of the right tract which supply the nasal half of the left retina, or had totally destroyed the right optic tract at the chiasma as well as the decussating fibres of the left tract. The radiographic examination has indeed permitted us to make a positive localization, but naturally it is impossible for us to be more precise.

On arriving at the brain, the bullet produced an effusion of blood which, once coagulated, compressed the right third nerve, which caused the ptosis and the paralysis of the right internal rectus on the corresponding side. At the end of a month the clot having been absorbed, the paralysis of this nerve disappeared.

The trifacial and the olfactory nerve were not affected, for the sensibility of the cornea and of the skin of the face was always normal, and the perception of odour unchanged.

Contrary to first appearances, it was the eyeball on the side opposite to that on which the bullet entered which, from the point of view of sight, suffered most from this injury, and the complete atrophy which resulted caused the sight of this eye to be irremedially lost. It is also interesting to note that the circulation at the fundus was bad, since the retina is pale and that the blood vessels are filiform. As for the left eye, nasal half of the disc is

completely atrophied, yet direct fibres of the left optic nerve transmit the luminous impression from the retina sufficiently well for the patient to count fingers at a distance of 0.30 centimetres. The calibre of the blood vessels of this eye is about normal. Proliferating retinitis localized here in the infero-external part of the eyeball is sometimes produced by severe chorioido-retinal hemorrhage, especially when there is a laceration of the chorioid, a complication which did not exist in our patient.

Foreign bodies such as bullets are rarely septic. In our case there was no elevation of temperature.

It is always astonishing to note to what point projectiles are tolerated by the brain without the outset to general phenomena. Our patient has never manifested any except headache, which, moreover, rapidly disappeared. He did not even lose consciousness after having been shot, and complained of no immediate symptoms arising from shock.

As for acromegalia, there was nothing to fear, seeing that the bullet was sufficiently distant from the pituitary gland to produce no change, and as the patient had arrived at an age where these affections have no longer their "raison d'être," as they are rarely met with except during the period of growth.

As this foreign body is now encysted, the surrounding tissues are for the same reason protected from contact with it, hence our patient is in no danger of saturnism, nor more is he likely to lose sight remaining.

In closing, we wish to draw attention once more to this revolver bullet lodged directly in the chiasma (diagnosis verified by the X-Ray examination), which has produced a series of most classic symptoms. Medical literature furnishes us with a very large number of cases of monocular or binocular blindness caused by projectiles which have caused the destruction of an optic nerve, with or without sympathetic ophthalmia, or again by projectiles which have destroyed both optic nerves at the same time. However, we know of no observations where a bullet has lodged in the chiasma and produced double blindness absolute of one eye and incomplete of the other, which could be compared to that which is the subject of this article.

HOMEOPATHY IN OPHTHALMOLOGY*

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I confess to some embarrassment in presenting this subject to you because of the radically different view points of the regular and the homeopathic physician in prescribing for disease. This radical difference makes it difficult for either to understand the other and not infrequently gives rise to ill feeling and distrust between men who are conscientiously doing their best, each in his own way, to relieve suffering humanity. If you will kindly bear with me while I point out some of these differences we may find points in which each may be of use to the other, and even though we end in agreeing to differ, we may have the mutual respect for each other that should result from honest men striving by different methods to reach the same goal, which in medicine means the relief and cure of those who suffer and are ill.

With the regular frequently the diagnosis of the disease determines its therapeutics, as e. g. syphilis, means K. I. Mercury, or Salvarsan; malaria means quinine or perhaps arsenic; and rheumatism means salicylic acid or some of its salts—in other words specific medication. Under the same head may be placed the serums and the bacterins. In other classes of cases, tonics for the weak, stimulants for the depressed, catharties and laxatives for the constipated, iron for the anaemic, etc. In diseases which have definite effects upon special organs or functions the stimulations, reinforcing, or sustaining of these in their times of need, etc.

Again remedies given to assist in elimination, or to aid in metabolism engage his attention.

While on the other hand every true homeopathic prescription is based upon the similarity of the symptoms of the drug upon the healthy individual to those presented by the patient seeking treatment. This implies an intimate knowledge of the action of many drugs as proven upon the healthy by one who would treat disease homeopathically and per contra, that no one can successfully use homeopathic remedies who does not so compare drug action with the condition presented by the patient to be treated in order to ascertain their similarity.

In studying the provings of a number of drugs we may find many symptoms in common, such as malaise, loss of appetite, weakness, general distress, headache, etc. The symptoms or conditions being

*A lecture given before the post-graduate course in Ophthalmology of the University of Colorado.

in common are of little or no use in prescribing, but upon closer study we find mental conditions, conditions of amelioration or aggravation, or symptoms which accompany each other with regularity, etc., which serve to distinguish or individualize or give character to the drug. We learn to distinguish drugs much as we learn to distinguish individuals, not by their general features, which are common to all, but rather by their peculiar expression and shape and habits. It may be a small and insignificant thing and yet one that is most expressive of the individuality of the person. In drugs it is not the general effect upon the stomach or bowels, nor the general debility produced, but rather the peculiar, or uncommon, prominent symptoms which serve to distinguish it from others. These symptoms which are known as key note or guiding symptoms may, from the physiological or pathological point seem trivial and unimportant, become of paramount importance to the successful homeopathic prescriber. They may show themselves in the faculty of the drug to attack certain locations, tissues or organs in certain definite ways; or in the character of sensations produced, as the burning pains peculiar to arsenic; the coldness of camphor and veratrum; sticking or cutting pains of bryonia; the stinging pains of apis and the soreness of arnica. Not infrequently the character of the pain serves to indicate the seat of its action; the burning pains in general pointing to the mucous membranes; dull, boring, gnawing pains to the bones; sticking, cutting pains to the serous membranes, etc. In many drugs these characteristics should be present if the remedy is to be effective. For example, mental anxiety and restlessness are so characteristic of aconite that no good homeopathic prescriber would think of giving it in fever in their absence, nor would arsenic be thought of without restlessness, though the fevers of the two differ so markedly that they would not be considered the same case. Besides the locality affected, and the character of the sensations, the remedy presents modalities or concomitants. The homeopath considers it important to note the peculiar manner in which the drug invades the animal economy; its aggravations and ameliorations; the times of the day and conditions of the weather when its action is most pronounced. Thus we find the marked increase of pain from motion of bryonia; relief of headache from wrapping it up warmly of silica; the marked preference for the left side of the body under lachesis; the nightly aggravations of mercury; aggravation from damp weather in dulcamara and rhus, etc.

The need of comparing the drug action with the case of disease to be treated at once eliminates specific remedies for a given disease because the same disease manifests conditions varying so greatly

that what would be similar in one instance would be anything but similar in another.

Take for example, rheumatism. A great many remedies might be considered, but for illustration we will take three, bryonia, rhus and apis. In the provings of *bryonia* it attacks the serous and fibrous tissues, its pains are sharp, cutting in character, greatly increased by motion, better from heat; the patient is irritable and wants to be let alone. The typical bryonia patient in rheumatism or other disease, irrespective of the name, is the irritable individual who wants to be let alone with a hot water bottle to apply to his painful parts, which are very tender to touch, and who keeps perfectly still because of the greatly increased pain from motion, and whose pains are described as sharp, shooting in character. This applies in iritis in which bryonia is the remedy. The eye is quite tender to touch (suggesting cyclitis) and motion of the eye greatly increases the pain. *Rhus* is given in rheumatism whether acute or chronic when the patient is restless because the pains are relieved by motion. The patient cannot find any comfortable position in which to rest. In the chronic forms when the patient is stiff and limbers up after moving about for a time. In acute rheumatism when though painful to move, yet he constantly moves for the temporary relief. Rhus, like bryonia is often an excellent remedy in iritis when the general symptoms correspond. It is the remedy par excellence in suppurative iritis of traumatic origin, as after cataract operation, in the presence of chemosis, oedema of the lids, especially if the swelling tends to involve the side of the face and to be covered by vesicular eruption; this condition would suggest its use in panophthalmitis in which the homeopath considers Rhus his most useful remedy, especially if attended by its characteristic restlessness, relief from motion, aggravation from damp weather, etc. Some years ago Dr. Horatio C. Wood wrote of having tried rhus tox., in one hundred consecutive cases of rheumatism, in doses varying from the tincture to the higher potencies with only indifferent success. You can readily understand from the above that his results could not have been other than indifferent, even though homeopathy were an accepted fact.

Apis, the poison of the honey bee, is well known to you in the effects of bee sting, which gives a typical picture for its use in disease. The red or rosy swelling or puffing up of the parts; the stinging pains, soreness, intolerance of heat and thirstlessness furnish the key notes to its homeopathic application in disease generally. It is given when the puffiness and swelling are out of pro-

portion to the apparent severity of the inflammation and when the pains are described as stinging in character. It does not control the deep seated suppurative inflammations as does rhus, though the puffiness of the lids is similar. The use of the bee sting in rheumatism has been known for many years and only recently has been highly extolled. Bob Burdette in his lecture on "The Rise and Fall of the Mustache," which I heard him give thirty-three or thirty-four years ago, gave a very amusing story of the boy whose rheumatic father had contracted with him for a number of honey bees at so much per, and who delivered a bottle full of bees with a hornet thrown in for full measure. The old man waited until the rest of the family had retired and gone to sleep when he carefully prepared himself for the remedy, taking his bottle to bed with him beside his sleeping wife, with very disastrous general results to the family. No statement, however, as to the effect upon the rheumatism. While I am satisfied from past experience that apis is a very useful remedy in rheumatism under certain conditions, I am equally satisfied that if given in one hundred consecutive cases it would be with very indifferent success.

To illustrate the application of homeopathic remedies I will report two cases, first Mr. A. L. T. Aet. 37. Clerk. Gives a history of chronic conjunctivitis with smarting and burning on use. Is exceedingly nervous, restless and sleepless at night. Muscles of the arms and legs twitch and has sensation of the muscles of the face twitching when he talks. Has been East twice in the hope of benefit from a lower altitude. Glasses prescribed two months before gave no relief. Refraction:

O. D.—50 ax 165°	exophoria 2° at 15′
O. S.—50 ax 15°	exophoria 12° at 13″

His symptoms of restlessness, sleeplessness and twitching of the muscles in different parts of the body corresponding to the action of the poisonous muchroom agaricus muscarius, this remedy was given in five drop doses of the mother tincture with almost immediate and permanent relief of nervousness, tremblings and sleeplessness. He slept well that night and continued to do so without twitching or restlessness, though a change in his lens was not made until some days thereafter. Later examinations showed no change in the refraction nor heterophoria. I might say in passing that agaricus muscarius has been used by me with like good results in a great many cases where the twitching of various muscles throughout the body have been the prominent symptoms, and many cases of sleeplessness attended by this twitching have been relieved as if by magic.

Further, if the case is not relieved inside of 48 hours it has not been my experience to relieve it at all with the remedy. The homeopath uses the remedy at times for the twitchings and spasmodic movements of muscles anywhere; from twitching of the lids to the choreic movements of St. Vitas.

The second case is that of Mrs. F. L. G. Aet. 31. Housewife, who gave a history of headache for many years. Had to give up school on account of them. The pains in the temples and back of the head. Is very nervous; twitching of the lids.

Wears O. D.+1.25=○=+50 ax 105°
O. S.+1.25=○=+50 ax 75°

Refraction under atropine gave

O. D.+75=○=+50 ax 105°
O. S.+50=○=+50 ax 75°

Various examinations showed esophoria 5° at 15 feet and also at 13 inches with right hyperphoria varying from 1° to 1½°, combined with cyclophoria due to insufficiency of right superior oblique. On account of the highly nervous condition of the patient, together with the twitching of the lide agaricus, mother tincture, was given when she first came, but to no apparent advantage.

Prescription of

O. D.+.75=○=.50 ax 105° 2° pr b out and down ax 22°
O. S.+.25=○=.50 ax 75° 2° pr b out and up ax 22°

Made May the 24th. A week later reported with an intense headache, careful inquiry revealed the fact that her headaches were as follows: "Intense pain in the left supra orbital region; increased by motion; flushed, purplish red face; eyes bloodshot. All symptoms relieved by nose bleed."

This is so typically the nature of the headache found under the provings of melilotus—the yellow melitot or sweet clover—that this remedy was prescribed with immediate, and according to her physician, permanent relief. The remedy was given in the 3x potency. You will note that in these cases the general symptoms and not the eye symptoms, determined the remedy, and the same must be true in nearly if not quite all homeopathic prescriptions.

It has not infrequently been my experience, after spending weeks or months in trying to relieve chronic disease of the eye or ear, to have the condition disappear almost as if by magic after some prescription made by the homeopathic family physician for some temporary general condition, and upon learning of the remedy given wondered at my own stupidity in not seeing what should have been patent to any one familiar with drug provings.

Among remedies of use to the oculist at times may be mentioned *calcarea carb.* The typical patient here is the child slow to develop, with big head, small neck, big belly, pale skin, chalky look, and who sweats profusely about the head and neck, and whose stockings are constantly wet from perspiration. The eye conditions for which this is the remedy are those due to faulty metabolism, such as phlyctenular inflammations of the conjunctiva and the cornea. Keratitis of different types, and chronic inflammation of the lid, especially its margins. Its eye symptoms are too general to individualize.

Fluoric acid. Has the symptom "sensation as if the eyelids were opened by force and a fresh wind were blowing on them." This symptom "as if a cold wind were blowing in the eye" has helped me out a number of times in different ophthalmic diseases, and is so reported by many others who have used it.

Graphites affects metabolism showing a tendency to develop a cutaneous phase of internal disorders. Its typical patient is the fat, chilly and costive. In the eye it is used for inflammations of the lids, conjunctiva and cornea when accompanied by eczematous eruptions which are moist, fissured and bleed easily, situated chiefly on the head, behind the ears and at the outer canthus where it cracks and bleeds from opening the lids. With this particular form of eczema present I am quite confident you will not be disappointed in its use; at least I have been much gratified. In the chronic blepharitis with the dry scurfs on the cilia, in addition to the use of the remedy internally I use a graphite ointment, one grain to the dram of vaseline, in preference to the yellow oxide. When the margin of the lids are pustular, antimonium crudum is a better remedy. The intense photophobia, especially in the early part of the day, together with skin conditions often make this a valuable remedy in phlyctenular ophthalmias.

Hepar sulphur of Hahnemann, an impure calcium sulphide, is the remedy where there is a tendency to formation of pus attended by great sensativeness to touch, with throbbing pains. It may prevent the formation of pus, or accelerate its discharge. It is used in phlegmonous inflammations of the lids; in dacryo-cystitis; in ulcers and abscesses of the cornea and in hypopyon. In the latter condition it has seemed to me of undoubted benefit in a number of cases. It is useful in suppurative inflammations in general, and should be used in suppurative choroiditis or panophthalmitis unless some other remedy is definitely indicated. I am of the impression that it acts best in staphylococcic infections.

Ignatia. The ignatia patient presents a variety of contradictory symptoms. It is used by the homeopath almost wholly in hysteria. It is the remedy for physical conditions following depressing emotions, especially grief. It has been of marked benefit in my experience in corneal ulcers, and other pathological conditions of the eye, occurring in those who mourn and weep excessively. It may or may not be a novel thought to you that conditions arising from the emotions can be met by any definite remedies, but it is now a generally accepted fact that intense emotions, or long continued mental attitudes, can definitely affect the physical well being of the individual. Hahnemann taught that the mental symptoms of drugs are always important. No all drugs produce mental symptoms, but many do; such as the anxiety, restlessness and fear of death of aconite; and the anxiety and restlessnes of arsenic and others; the indifference of gelsemium, the irritability of bryonia, the mild, gentle tearfulness "can't tell her story without weeping," of pulsatilla, etc. Those of us who have been using homeopathic remedies have no reason to question the value of this part of his teachings.

Ledum Palustre. Is used locally and internally for hemorrhages, subconjunctival, or within the eye, whether in the acqueous, vitreous or elsewhere. I have thought with very definitely good results in a number of cases.

The *mercurials* are used so generally and with so nearly the same conditions that there is little to add about them at this time.

Under the provings of mercury every organ and tissue of the body is more or less affected, especially the lymphatics, internal organs, bones, nerves, etc. Its symptomatology runs so close to that of syphilis, for which it is practicaly a specific, that it raises the question as to whether it is not in every sense a verification of the law of similars. I have long since been sufficiently satisfied with the results of specific treatment as generally applied to use it and leave for others to determine whether homeopathic or not, and if not by virtue of what particular function or power it succeeds in destroying the spirochetes.

Paris Quadrifolia has the symptom "sensation as if threads drew from the eye into the middle of the head." I have met with this at rare intervals, but have always found relief of the condition, irrespective of its diagnosis, when paris was used. Dr. Norton, of New York, reports cure of paralysis of the iris and ciliary muscle, supposed to be due to injury received two years previous, with this symptom as a basis of the prescription.

Pulsatilla has produced swollen, inflamed lids with styes, and is a

most excellent remedy in styes which come in crops, especially in the form where there is a large amount of pus. The general symptoms of mild, tearfulness with chilliness, and yet feels much better in the open air, is so characteristic of pulsatilla that these symptoms, rather than pathological conditions about the eye, will be the indications for its use. My preceptor, Dr. B. Bowman, of Chambersburg, Penn., was cured completely of recurring styes of long duration by the remedy. Its inflammations of the eyes are usually superficial, involving the conjunctiva, the superficial layers of the cornea, the lids and the lachrymal sac, giving rise to rather free thick purulent discharges. Though in the typical pulsatilla patient I once saw a rather sharp attack of glaucoma subside quickly without return.

Ruta Graveoleus has been my mainstay for the asthenopic symptoms "sensation of heat and fire or burning aching in the eyes; aching in the eyes from reading too long." "Eyes feel as if strained." I use it when the glasses prescribed fail to give relief and when the asthenopia is due to a weak ciliary muscle—accommodative asthenopia. Two other remedies used in accommodative asthenopia are, conium maculatum, which combines hyperaesthesia of the retina with sluggish accommodation, and argentum nitricum, which has more catarrhal symptoms than ruta. I do not hesitate to insist that these remedies are of undoubted benefit in selected cases.

Zincum. This remedy has an especial affinity for the inner canthus, and is prescribed for conjunctival inflammations, which are chiefly confined to the inner canthus, with the itching and stinging pains of the inner angles of the eye. Several well marked cases of pterygia have been reported cured by its internal administration. I have not seen any cures from it in this condition, but have seen marked reductions in size take place so soon after its administration that there seemed no room to doubt its specific effect. In the conjunctivitis attending chronic inflammations of the sack it is an excellent remedy.

In this short list I have purposely omitted many most valuable remedies because to have presented them to any purpose would have led us too far from the object of this paper. I have aimed to give only a few remedies with definite indications in order to, in some slight degree, indicate to you the mental processes involved in making a homeopathic prescription, and in addition thereto to point out a few remedies which may be used with some degree of success by one who is not prepared to make a homeopathic prescription,

and yet who may wish to give the remedies a trial in suitable cases.

It has not been my purpose to discuss theories of action of the remedies—I frankly confess I do not know how they act—but rather to confine myself to the practical side of the question.

It must be evident to you by this time that the diagnosis of the disease is a distinctly separate mental process from that involved in the selection of the homeopathic remedy, and that neither is complementary to nor dependent upon the other.

This lack of interdependence has led in some instances to carelessness in diagnosis by the Homeopath with claims of cures that could not be sustained by a more painstaking examination, with the result that Homeopathy has suffered from its over-zealous advocates.

We have all seen the gumma and other severe pathological conditions of syphilis melt away and disappear rapidly under the administration of specific medication until we have ceased to marvel at it. But just as surely have I seen severe pathological conditions rapidly disappear under the administration of the Homeopathic remedy time and time again. I am convinced now, and have been for years, that it is the greatest single factor in medicinal therapeutics today.

RECURRING NEURITIS.

Dr. H. Terlinck,

BRUSSELS.

Translated by J. Franklin Chattin, Newark, N. J.

About the middle of February, 1911, a woman, aged 25, presented herself at Professor Gallemaert's clinic with the following history:

In December, 1910, having shown a marked papular-roseolar rash, she received an intra muscular injection of 60 ctgr. of Salvarsan. Following this injection her general condition was much improved, but fifteen days later the patient noticed a decided diminution of the vision of both eyes, accompanied by frontal headache.

Examination as follows: Double optic neuritis, more intense in the right eye. Visual acuity, right=20/200, left=20/50. Visual fields with both eyes in the horizontal meridian; nasal 55°, temporal 80°. Pressure on the eye balls produced a painful sensation.

We saw the patient again June 17, 1911. Four days previous to this she received an intra-venous injection of 60 ctgr. of 606. Yesterday the right eye became painful and injected and at the time of the examination the right eye presented the symptoms of specific iritis. Visual acuity unchanged. Treatment: atropine.

On June 20 she again received an injection of 60 ctgr. of 606 (whether intra-venous or intra-muscular, not stated). On the 10th of July following we noticed that the iritis was cured and the condition of the optic nerves was improved. Visual acuity: R. E. 20/c, L. E. 20/xl.

July 12, injection of 40 ctgr. of Salvarsan.

July 15, patient noticed during the course of her work a sudden obscuring of the vision of the right eye. We saw her on the 17th following and the fundus was not visible except at the upper and inner half of the field; the papilla was scarcely visible; the entire infero-external region was occupied by a vast hemorrhage. Treatment: atropine and rest.

July 29th the fundus was much clearer. Vision amounted to seeing movements of the hand. Patient was ordered 2 grams of potassium iodide daily.

August 10th, L. E. V.=20/cc, R. E. V.=fingers at 3 feet. The vitreous is the seat of fine opacities. Treatment: 3 grams of potassium iodide daily and hot compresses.

September 8th, L. E. V.=20/xxx and the fundus seems clear; R. E. V.=fingers at 6 feet.

January 15, 1912, I saw the patient and she seemed to be in a condition of flourishing health; she had had no treatment for the

past four months. The fundus of the right eye appeared clear, but in the retina, down and out, appeared a large spot of atrophy marking the seat of the hemorrhage. R. E. V.=20/lx, L. E. V.= 20/xx. Wasserman negative.

In summing up it will be seen that this patient had submitted to an energetic cure by Salvarsan, each injection being followed by an ocular accident. In this connection, on the other hand, it is remarkable that the accidents manifested themselves exclusively to the visual apparatus and with a particular intensity to one eye.

At the present day the fears of poisoning by Salvarsan, under the form of atrophy of the optic nerves, which has given to atoxyl and other arsenical preparations an undesirable celebrity, no longer exist. Yet there have been published a number of related accidents occurring in the nervous system after injections of 606, with which the medical profession has been undoubtedly and disagreeably impressed.

It is true that we have seen analogous accidents produced during the epoch when mercury alone was employed—I find among my notes of observation one of double optic neuritis which supervened during the course of treatment by injections of grey oil, and who of us has not seen an iritis develop during a cure by inunctions?

By the light of these discussions, which have arisen concerning the recurring neuritis of Salvarsan, these cases have found their true interpretation. I am going to report an observation which I believe will not be without interest:

B., 50 years of age, was infected 11 years ago; three years ago I treated him for iritis of the left eye, which disappeared rapidly after injections of enesol. The patient submitted to a prolonged intermittent treatment by his family physician (a series of injections of enesol three times a year). During the course of the last series of injections, the sixth, the patient, who up to that time had not shown any symptoms, had a violent attack of iritis (Dec. 15, 1911), which did not yield to two series of enesol injections.

I saw him January 9, 1912, and found these conditions: Intense injection of left eye; hyphema occupies three-fourths of the anterior chamber; intense pain. I gave him an injection of 30 ctgr. of enesol, which resulted in immediate improvement. In eight days the patient received three injections of 30 ctgr. The hyphema disappeared and the inflammation subsided. Subsequent treatment was mixed: Salvarsan and grey oil. By March 12th he had received 2 grams of Salvarsan and 80 centigrams of mer-

cury. Wassermann's reaction, which in the beginning was ++ ++, became negative, and was still so on May 15th last.

These two cases above cited, it seems to me, are an argument in favor of the explanation which Ehrlich himself has given to these accidents: that they are due to deposits of spirochetes in distant interspaces of the organism, but little accessible (for example, the osseous canals), and which take on a new virulence when the rest of the organism has been sterilized by the injection. The fact that these accidents are curable by a new injection of Salvarsan is sufficient proof. As to the relative abundance of the accidents, it is not necessary to refer to the hypothesis of the neurotropic action of Salvarsan (Buschke).

It is also proper to admit that we have rarely encountered these accidents with mercury, because this medicament is not administered in as large doses nor in as direct a manner as by the intravenous method.

Concerning the hemorrhages, retinal in the first case, and of uveal origin in the second, there is no reason for attributing either of them to a toxic action of the drugs employed; in fact, we know the predilection which syphilis possesses in attacking the vessels, and although accidents of this character and magnitude are rare, we can consider that both cases were local syphilitic lesions awakened by the treatment.

The study of recurring neuritis should not be separated from that of the general therapeutics of syphilis; yet it seems that their very existence pleads in favor of mixed treatment: Salvarsan and mercury.

MALINGERING (PRETENDED BLINDNESS.)*

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Malingering on the part of patients in one form or another is very common. Ophthalmologists meet it among patients who pretend blindness, partial or total, in one or both eyes.

Occasionally also, patients will exaggerate an injury or make it worse by putting into the eye some irritant such as sand or some irritating solution like copper sulphate.

In this lecture we are going to consider only pretended blindness.

Motives. Patients sometimes pretend to be blind or partially blind for the purpose of securing damages as a result of a supposed or real injury. Often it happens that the patient really has suffered some slight injury, but claims a greater defect in eyesight than really exists, with the object of securing larger damages. Others pretend blindness in order to secure pensions, insurance money, etc., while others may feign blindness in order to avoid military duties or to be admitted to some charitable institution. Children sometimes pretend defective eyesight in order to avoid school duties. In the latter class, and often in the case of some adults, a very effective method of discovering deception and bringing about good vision is to prepare for an operation on the supposed blind eye.

It does not often happen that a patient will claim total blindness in both eyes, as it is a very difficult task for a man to play the role of being totally blind in both eyes. It is almost impossible for a man to deceive those who see him daily, and there will usually be found some acquaintance who is ready to testify against him.

One case that came under my observation was that of a patient who claimed total blindness in both eyes and played the part well. However, testimony was introduced to show that during the time he was supposed to have been totally blind he had been observed by several to have been able to pass his cane through the loop produced by the complete curl of a small dog's tail.

Most of these patients are ignorant as to the various tests, but some of them may be intelligent and more difficult to entrap. The examiner must be alert and the proper tests for the individual case will have to be elected. With a careful study and the proper applications of tests the examiner should be able in practically

*A lecture delivered before the class in the summer course on Ophthalmology at the University of Colorado in Denver, July 23rd, 1912.

every instance to convince himself as to whether or not the patient sees in both eyes and in most cases will be able to determine quite accurately the acuity of vision.

The examiner has to guide him the objective and subjective tests.

The refraction of both eyes should be secured by the use of the ophthalmometer and skiascopy. The eyes should be inspected externally and with the ophthalmoscope previous to making the subjective tests.

Most of the tests require the correction of any refractive error while being made, and the ophthalmoscopic examination will be of value in determining whether or not disease exists and the condition of the pupil—as to whether adhesions exist, for instance.

Objective Tests.

These depend mainly upon two points, i. e., first, the reaction of the pupil; second, the direction of the visual axis.

Reaction of the Pupil. This consists of determining whether or not there exists reaction of the pupil to light and whether or not this reaction is consensual. As you all know, reaction to light may not take place even when sight exists, as when synechiae are present or in paralytic mydriasis, but your knowledge of ophthalmology will enable you to eliminate such defects as causes of lack of mobility. Contraction of the pupil to the light is a reflex motion, the optic nerve serving as the afferent nerve and the third nerve controlling the sphincter pupilae serving as the efferent nerve. Consequently, the reaction to light is good evidence of the existence of sight, and the more prompt the reaction (depending, however, somewhat upon the patient's age), as a rule, the better the sight. Of course, it is impossible to determine the degree of sight accurately by such a test, and it is further possible to secure a further reaction to light even in a sightless eye.* Practically, however, if contraction of the pupil to light takes place, we may consider it probable that sight exists, and a test of positive value is the following: If contraction of the pupil to light applied to an

*B. Von Gudden has shown that there are special efferent nerve fibres in the optic nerve for the pupil reflex distinct from those of vision and that it is possible to distinguish with the microscope these two kinds of nerve fibres from each other.

Light stimuli are conveyed by the optic nerve, chiasm and tractus to the corpora quadrigemina, and thence by Meynert's fibres to the center of the third nerve in the floor of the fourth ventrical controlling the sphincter pupilae and thence by the third nerve to each sphincter. In the optic chiasm there is a semidecussation of fibres, therefore the stimulus of light even when applied to one eye alone passes up each tract with equal vigor to both the right and left oculo-motor nucleus, thus causing consensual reaction. Furthermore, there is a communication between the nuclei of the motor oculi, so that even when a lesion is located on one side beyond the chiasm consensual reaction takes place. Accordingly, a lesion located in the centers of vision or beyond where Meynert's fibres branch off might produce total blindness and not interfere with pupil contraction.

eye does not take place in the eye where applied and consensual reaction does take place (i. e., reaction of the pupil of the eye to which the light is not applied), it is evidence of the fact that the eye is blind.

In testing the reaction of the pupils to light, the patient's gaze should be directed straight ahead, the light cut off by the observer's hand (covering both eyes), which should then be suddenly removed, and the effect of the sudden stimulus of light noted. The presence or absence of consensual reaction is shown by keeping one eye shaded while the other is exposed to the light, noting the effect on the shaded eye as well as the effect on the eye exposed.

In making tests in any case of partial or total blindness in one or both eyes, bear in mind that contraction of the pupil takes place in conjunction with accommodation and convergence (all of these actions being controlled by the third nerve and the three neuclei for these actions, being situated contiguous to one another and connected by association fibres). Therefore, when making the test of the reaction of the pupil to light, the patient should focus his vision at the same distance during the entire test.

The fact that the pupil of the alleged blind eye remains motionless when exposed to a bright light, whereas it contracts to convergence and accommodation, points to the existence of monocular blindness.

In testing the totally blind eye the other tests which you have to depend upon are the customary objective tests with the ophthalmoscope to determine whether or not there is present any intro-ocular or fundus lesion, taking the tension, determining the depth of the anterior chamber, noting the transparency of the lens, etc., with all of which you are very familiar.

In case the patient has used atropine in one eye there will be a maximum dilatation of the pupil and no reaction of the pupil in the atropinized eye. The sensitiveness of the retina to light in this eye may then be tested by observing the consensual reaction of the pupil that takes place in the other eye when the light stimulus is applied to the eye with the dilated pupil, and will serve as correctly as a guide as if the reaction took place in the eye where the light stimulus was applied.

Your knowledge of the reaction of the pupil to light and convergance will enable you to work out in each individual case the proper pupil tests to be applied.

Fixation of Vision. The absence of the physiological stimulus of binocular fixation of vision allows a blind or partially blind eye

to assume the anatomical position of rest, which is upward and outward, and we find in the case of an eye which is partially or totaly blind that it fails to maintain proper fixation.

When, therefore, perfect parallelism exists under all conditions, it is good evidence of the presence of sight, and furthermore, of sight which is nearly as good as the sight in the other eye—good enough, at any rate, to produce single binocular vision.

In testing fixation vision, remember that there are some cases of strabismus in which the patient may consciously or unconsciously free accommodation from convergence and may suppress the image in one eye.

Harlan's Test. Place a pair of trial frames on the patient, correcting refraction of alleged blind (right) eye, and over seeing (left) eye place a strong (15 or 20 dioptres) concave or convex spherical lens. Urge the patient to read while both eyes are open. If he succeeds it is with the eye he has claimed to be defective and his answers indicate approximately the degree of his visual acuity.

Jackson's Test. Place two strong cylindrical lenses before the seeing eye, one convex to neutralize the concave. Without the patient's knowledge suddenly turn one lens at right angles to the other, allowing the patient to continue reading.

Test With 10 *Degree Prism.* A 10 degree prism is placed before the seeing eye, base down or out. If it produces double sight when looking at the candle light the patient must be seeing with both eyes. This test only determines that fact and does not determine the acuity of vision. The patient may be aware of this test and deny that he sees double.

Test With 40 *or* 50 *Degree Prism.* Place a 50 degree prism, base down, over the seeing eye while the patient is looking at a light or some letters across the room. This will throw the object looked at out of the field of vision for the seeing eye, and if the patient continues to read the letters or sees the light he is seeing with the alleged blind eye.

Test With Double Prism. A double prism with bases together may be placed over the seeing eye in such a way as to produce monocular diplopia. If the patient sees three lights he is seeing one with the alleged blind eye. If he denies seeing two lights when the prisms are properly placed it is evidence of dishonesty.

Test With Black Disc With Small Central Opening. A test which the writer has practiced with success consists in using a black disc with an opening in the center (which is placed over the seeing eye. in which there may be a prism or the double prism),

The patient is instructed to look at the light or the letters across the room and asked to read them out loud. While he is reading them the head is gradually moved by the examiner so that the chin is raised in such a way that the visual axis passes through the opaque disc. If the patient continues to read he is reading with the alleged blind eye.

Javal-Cuignet Method as Modified by Martin. The apparatus may be made by using a shoe box about twelve inches long, in one end of which two apertures may be made through which the eyes of the patient are to look. At the other end some printed matter is placed. Five inches from the printed matter in the median line a hole is made through which an ordinary lead pencil may be inserted. With the light to the back of the patient the examiner may face the patient so that he can observe his eyes, and the patient is instructed to read. The pencil will interfere with continuous reading of the words unless the patient has reading vision in both eyes.

Driver's Method. Driver similarly interposes a vertical ruler about $1\frac{1}{4}$ inches wide between the patient's eyes and two of Snellen's test types in such a way that the ruler acts as a screen before the seeing eye, hiding the right test type from the left eye and the left test type from the right eye. If the patient succeeds in reading the letters on the two cards the fraud is disclosed and the degree of vision indicated.

Test With 6 Diopter Convex Lens. The normal eye may be rendered myopic with a 6 diopter convex lens. Test type is placed very close to the eyes and the patient allowed to read, gradually increasing the distance until the reading is beyond the focus of the seeing eye. If the patient continues to read he is reading with the alleged blind eye and the degree of vision is approximately measured thereby.

This test may be reversed by placing the strong lens over the alleged blind eye and allowing the patient to read at the normal focal distance of the seeing eye; then placing the print within the focal distance with the eye covered with the 6 diopter lens and nearer than the near point of the seeing eye. In this test a trial frame should be used and plain lens placed over the seeing eye if it is normal or if required, the patient's presbyopia being corrected so as not to bring the focus, however, at near point nearer than ten inches.

Baroffio Test. This consists in the use of atropin or eserine. Baudry suggests pilocarpine may be used to better advantage, as

it does not produce the symptoms that either of the other drugs produce. This should be dropped into the normal eye, and it will bring the reading focus so close that the patient will be unable to read with the normal eye unless the print is held very close. In this test as in all others we should take note of the state of refraction.

Test With Mirror for Slight Defects of Vision. If the malingerer is pretending to have only a slight defect of vision the test with the mirror in one of various ways is of value. The best method is to use a test type of symbols (instead of reverse letters, which may excite the patient's suspicion) such as the E's placed in various positions. Place the patient midway between a mirror and a chart of E's (or other symbols or letters like H and O, which appear the same both ways), at which he looks, then have him read the smallest he can. Now have him turn half way around and read them in the mirror. The distance by the mirror is three times as great, and his visual acuity is measured accordingly. Similarly two charts may be used, one with reverse letters. The patient is told to read a chart across the room, and then in a mirror beside it which reflects reverse letters that are placed over his head. Thus the letters seen in the mirror are located double the distance of the direct letters from the patient, and the acuity of vision may be determined. The malingerer is apt to read in the mirror the corresponding line to the direct letters, showing that his vision is twice as good as he pretends.

Test With 6 or 8 Degree Cylinder. Place upon a piece of paper a number of vertical lines. Place over the seeing eye the strong cylinder, axis 90. Holding the paper at a definite distance, not nearer than three feet, ask the patient to count the number of lines. If he succeeds it is evident that he has good vision, which may be quite accurately measured, as it is impossible to count the lines through the cylinder.

Priestley Smith and E. Jackson. Movements of the eye using a 6 degree prism, noticing the movements of the eye in the effort to secure singular binocular fixation. Supposing, for instance, we place a 6 degree prism, base out, before the alleged blind eye while he is fixing his vision upon a bright light at the other end of the room. The effort to secure binocular fixation of vision will cause the right alleged blind eye to turn inward and again to go out when the prism is removed.

von Welz. This same test is suggested by von Welz, using a 20 degree prism base outwards and having the patient read at the

reading distance, observing the movements of the eye during the reading.

Cuignet Test. Lighted candle is brought in front of the good eye and is slowly carried toward the side of the blind eye. Patient is detected if he declares that he still sees the candle when it is just concealed from the sound eye by the dorsum of the nose.

Duane suggests a method to prevent the malingerer from outwitting the examiner by slyly closing the alleged blind eye as follows: While the patient is reading out loud quite fast and is occupied with what he is doing, suddenly place a prism of four degrees, base down, over the alleged blind eye, making sure that the eye is open at the time. If the sight in this eye is really very poor, it will make little difference to him whether the prism is placed before it or not and he will read as before, but if he sees fairly well with this eye the interposition of the prism will cause confusion and he will either stumble in his reading or be unable to continue.

Berthold's Test. While a prism of twenty degrees' strength is being rotated before the feigned blind eye, the patient is requested to read aloud some small printed matter. This will be an exceedingly difficult procedure for the patient to do if good vision exists in both eyes.

Baudry's Test. Baudry has devised an apparatus by which there is obtained a series of double images that are so similar that the malingerer cannot distinguish the false from the real one or discover whether the double vision is of a monocular or binocular diplobia. A dark glass or even color is placed before the flame of a candle which is situated at a distance of three meters. "A triangular prism (see fig. 1) divided into two parts by a line of horizontal section, C′D, is united by its base A′B to a transparent medium, C, with parallel surfaces and of the same thickness. The whole glass represents one portion of a beveled mirror without mercury, divided into three distinct parts, A, B and C. which lie with their unpolished cut surfaces in apposition. This glass is concealed in a circular metal box which is perforated on each surface by a central opening, one of which has a diameter of six and the other of three millimeters. A simple mechanism which allows sometimes one and at times the other of the two lines of separation (A′B′ or C′D′) and at the same time a small part of the adjoining portion of the glass to be brought before the pupil of the sound eye, is thus obtained. As the lines of division and the adjoining portions of the glass that are brought before the pupil are absolutely identical in appearance, sometimes monocular and sometimes

binocular diplopia, unknown to the malingerer, even if he knows in advance the construction of the instrument, can be evoked with the greatest ease."—Baudry.

This test may be used in various ways, which the examiner will be able to work out for himself.

Snellen's Test. This depends upon the fact that while similarly colored rays may pass through a colored glass, rays of a complementary color are stopped. Supposing, for instance, we have made a certain number of letters of a definite size, these letters being upon glass through which the light can shine and being alternately red and green, the background being opaque and black. Now place this chart of letters over the window in such a way that the light will shine through the glass. Place upon the patient a trial frame containing a red glass over the seeing eye. If the patient is blind in the other eye the green letters will appear black and he will only read the red letters. If he reads the green letters in addition to the red ones he reads them with the alleged blind eye; thus the acuity of vision may be measured.

Test made with red and black letters on white background. Print upon a white paper with a red pencil words alternately red and black. Now place over the seeing eye a red glass. If the patient is blind in the other eye he will be only able to read the words printed in black. If he reads them all he is reading with the alleged blind eye and the acuity of vision may be thereby measured.

Stereoscopic tests. These may be made with the ordinary stereoscope, the printed matter so arranged that certain portions of it are not present before one or the other eye. If the patient reads consecutively he is reading with both eyes. This test may be greatly varied by using different symbols or figures, only a portion of which is present on each side so that it requires binocular vision to see the complete figure.

Test with the Worth Amblyscope. Another test which I have not seen described but which I have used with great effect in one

case and one which had more effect on the jury than any other test is the use of the Worth Amblyscope. The amblyscope should be so arranged that when the normal eyes look through it the images are crossed. The amblyscope should be carelessly laid upon the table or in such a manner that the claimant can clearly see that the tubes do not cross. Now let us take two subjects and let us place in the tube which will be seen by the right (blind eye) a picture of a bird which is much smaller than the bird cage which will be placed on the left (seeing) eye. Now, let it be remembered that the amblyscope is so arranged that these images are crossed so that the bird-cage will be on the right though seen by the left eye and the bird on the left though seen by the right eye. If the claimant is malingering, having previously observed that the tubes do not cross, he will claim to see only the object on the side of the admittedly seeing eye, in this instance, the bird. This conclusively proves not only that he is malingering but that his sight is good in the right eye.

Feigned Total or Partial Blindness in Both Eyes.

As previously mentioned simulation of total blindness is unusual because of the difficulties entailed in carrying out the fraud in the daily routine. It is more often met with in hysterical subjects and occasionally in those who are amblyopic in both eyes. One who is really totally blind assumes a characteristic attitude. He walks with a hesitating step and has an expressionless face and a dull stare. His eyes turn upward and perhaps slightly outward.

The objective tests have been given above. The tests for the reaction of the pupil to light and the directions of the visual axis are important. A history of the case to determine the length of time which the patient claims to have been totally blind may be confirmed or unconfirmed by the testimony of those with whom he has lived. These patients should be taken unawares.

A test may be made pretending that the examiner is trying to find out whether or not the patient can determine direction in hopes to catch him off his guard. The examiner may go to one side of the room and ask the patient to approach him. In his way may be placed some articles of furniture, though care must be taken that the patient may not injure himself. Observation should be made

as to whether or not the patient avoids the objects placed in his way.

A patient who complains of sudden total loss of vision must assume the attitude and gait of a blind man, walking stiffly and hesitatingly with hands outstretched; face impassive; expression dull; eyes turned upwards; eyelids immovable even at sudden flashes of light or objects threatening and quickly brought towards his eyes. The compression bandage may be applied for a day and see if the patient can maintain the role of the blind patient as well as when both eyes are uncovered.

Schmidt-Rimpler suggests that the patient be told to look at his own hand which he holds a short distance from his eyes. A blind man will easily succeed in casting his eyes in the direction of his own hand while a pretender may affect to look in a different direction, believing that he is thereby deceiving the examiner.

Field of Vision. Fantastic fields of vision may be secured. Maps should be made of the fields taken at different distances. It will be found in the case of a malingerer that they do not correspond. The map shown at the greater distance will be apt to show a smaller field than that taken at a near point. Fields taken for various colors may not correspond to the normal state or to any diseased condition. Such fields will prove confusing to the patient and of value to the examiner in determining whether or not he is honest.

Priestley Smith suggests the application of the van Welz test to supposed cases of total blindness. The patient is placed in a semi-darkened room, a candle light being situated in front of him in such a way that he naturally will cast his eyes toward it without being instructed to do so. A prism with its base inward is placed before one eye. If vision exists the eye will move outward and again inward when the prism is removed.

Jackson calls attention to the fact that even if one eye is nearly blind the seeing eye will move behind the prism, but in that case the blind eye will move in the same direction and to the same extent, whereas if binocular vision exists the other eye will not move in either direction.

In conclusion let me explain that I have not attempted to give all of the tests which are suggested nor to describe some of the very ingenious contrivances that have been invented for making these tests. I have endeavored to simply bring out those which seem to me of value and which can be applied by anyone without special and elaborate apparatus.

With some of these tests it will be exceedingly difficult for the most expert to deceive the examiner, while in some instances it will require a sufficient knowledge and a good degree of cleverness to outwit the malingerer who may be well informed and cunning.

SOME CLINICAL AND PATHOLOGICAL ASPECTS OF GLAUCOMA: A RETROSPECT OF TWO HUNDRED CASES.

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SUMMARY OF CONTENTS.

1. INTRODUCTORY REMARKS.

The object of the present contribution is to record the results of study of a wealth of interesting clinical material derived from the Ophthalmic Department of the Royal Victoria Hospital, and from the author's practice. The importance of the subject of glaucoma from every view-point cannot be over-estimated, not only because of the frequency of the condition, but because of the fact that neglect of observation of the early symptoms of the disease may mean subsequent total and irretrievable blindness.

During the past sixteen years, out of a total number of 3,371 admissions to the eye-wards of the hospital, 185 cases, or 5.49 per cent, constituted examples of various types of glaucoma. These figures indicate the clinical prominence of the subject. In the following remarks, the various aspects of the subject are gathered together, and a review of the theoretical considerations is presented, with special reference to the opinions which the writer has been led to form upon the pathological findings.

2. HISTORY OF THE SUBJECT.

Hippocrates was the first author in whose writings the word "Glaukos" is used for describing a diseased condition of any eye; he, and many of his followers, no doubt confounded the condition

now understood by us as glaucoma with cataract. It was Brisseau, in 1709, after an anatomical examination of the eyes of Bourdelot, the blind physician of Louis XIV., who demonstrated that the seat of glaucoma was not in the lens. He attributed the disease to vitreous opacities, a view which met with wide acceptance by such men as Beer, Demours, and Middlemore.[4] MacKenzie,[2] in 1830, was the first to draw attention to the increased tension or hardness of the globe. Some authorities about this time, as Wenzel,[1] Wardrop, and Tyrell, considered glaucoma to be the result of diseased processes in the retina and optic nerve, while Lawrence,[3] von Ammon,[5] Sichel, and Arlt, indicted the choroid. The advent of the ophthalmoscope ushered in a new era in our knowledge of this disease, and Julius Jacobson first employed the instrument to investigate the disorder. Jaeger,[7] in 1854, was the first to describe the glaucoma cup, but erroneously regarded the condition as the result of swelling of the optic nerve. Von Graefe,[8] in the same year, came to a similar conclusion, but corrected his affirmation shortly afterwards, asserting as his opinion that glaucoma was due to a serous choroiditis which caused increase in the volume of the vitreous, a rise in the intraocular pressure, and a compression of the retina. MacKenzie's original idea of increase of intraocular tension was thus again advanced. The first definite step forward, made by von Graefe in 1856, resulted from the observation of the results of performing an iridectomy on lower animals. The same operation had been performed by him for corneal ulceration.

To quote Priestley Smith,[17] whose name will ever be associated with this subject: "Glaucoma is a complex morbid process depending essentially on an excess of pressure in the chambers of the eye. The initial causes of this excess are very varied but they culminate in all cases in an obstruction to the escape of the intraocular fluid; hence the increased tension of the eye which is the leading symptom of glaucoma." It is this excess of pressure that gives rise to the other symptoms. Thus, the acute cases are much more severe and emphatic in the manifestation of severe pain, intense congestion and rapid loss of sight than are those of the chronic variety, which often show little or no external evidence of the serious nature of the disease.

The theories regarding the secretion and circulation of the intraocular fluid were originally almost as numerous as the authorities proposing them. It was reserved for Max Knies[9] and Adolf Weber,[10] working independently, to remark on the frequent obliteration of the filtration angle in cases of glaucoma.

3. Clinical Types of Glaucoma.

Acute Primary Glaucoma. This may readily be mistaken for an ordinary catarrhal conjunctivitis, erysipelas, or for an attack of neuralgia;—a misinterpretation of conditions which is responsible for the most lamentable of the results. There may be prodromal symptoms of dimness of vision and of rainbow phenomena. Occasionally the disease may arise in an eye which has always been considered by the patient as a healthy one. Premonitory symptoms are more frequently absent in the old. The exciting cause may be exhausting illnesses, a chill, mental or physical exhaustion, and sleeplessness. The use of atropine or of one of its alkaloids in the eye may induce an attack. Pain is generally the first warning and its presence is sudden and acute, increasing gradually in intensity and perhaps including the whole of the side of the face or head. Vomiting may occur in intense cases and in a short time the patient is prostrated with the severity of the pain. Vision is markedly impaired and by the time the patient is seen by the consultant, definite physical manifestations of the disease are discernible. The lids are swollen, the conjunctiva is red and perhaps chemotic, the subconjunctival vessels (particularly the pericorneal plexus and the main trunks connected with it) are injected. In severe cases the eye may appear proptosed; lacrimation and photophobia are present. The corneal lustre has disappeared and that of moistened ground glass has taken its place. If high tension has been present for some days the corneal sensibility is diminished. The pupil is somewhat dilated and is inactive. The anterior chamber is abnormally shallow and the tension as compared with the healthy eye is distinctly raised, facts which should readily establish a diagnosis. Vision of the affected eye is always distinctly impaired and may, in the course of a day or two, include merely the central field, or it may be altogether lost. The œdematous condition of the cornea prohibits a satisfactory examination of the fundus oculi.

The acute manifestations may remain untreated for weeks and slowly subside, and with their disappearance there may be some slight return of vision; but the eye remains hard, and the balance of sight is gradually lost.

The intensity of the onset of symptoms in acute glaucoma varies to a pronounced degree; the most severe cases have been termed "fulminating." A condition of total blindness is reached more rapidly in this than in any other form of glaucoma.

Subacute Primary Glaucoma. This form is characterized by occasional prodromal attacks of obscured vision with rainbow

phenomena. These attacks become more frequent and more severe, and gradually the glaucomatous condition is persistent and complete. Tension is elevated, excavation of the disc begins and retraction of the field of vision is observed. Acute exacerbations of pain are experienced by the patient, the globe becomes injected, and unless treatment is adopted, total blindness, as in the acute variety, is the inevitable result. "Inflammatory glaucoma" is merely a term employed by some writers to describe the acute form of this disease where manifestations of congestion are apparent. In the series investigated, forty-one cases were of the acute and subacute variety*.

Chronic Primary Glaucoma. (Glaucoma Simplex). The onset of this form of the disease is most insidious; it progresses slowly with little or no tendency to acute exacerbation. This form may run a course of months or years, but the ultimate destiny of such cases is as in the more acute forms of the disease. As a rule one eye is affected at a time and the diseased eye may be almost blind before the patient notices that there is anything amiss. There may, at times, be a history of rainbow vision, but this is by no means always present, and a history of nervous or physical fatigue is generally elicited. At first examination, the eye may show little if anything wrong; there may possibly be some engorgement of the anterior ciliary vessels and the anterior chamber may be somewhat shallow. There may also be some dilatation of the pupils with sluggish response to stimulation. An eye already blinded by chronic glaucoma may have a non-dilated pupil which is consensually active. By external examination, the lens may appear grey and opaque, but it is in reality perfectly clear allowing an uninterrupted view of the fundus. The intraocular tension is elevated, at first very slightly so, and sometimes only on certain occasions. In the later stages it may be of stony hardness, yet on account of the very gradual progress of the disease its advance is not marked with pain. Cupping of the optic disc with dipping of the veins is noted and the field of vision is contracted.

A definite diagnosis of chronic glaucoma is frequently difficult to establish, owing to the variation in intraocular tension which at

*It must be pointed out that the statistics obtainable from the clinical records are not always as satisfactory as is desirable, owing to the inevitable error which arises from periodical changes in the house staff. The clinical report and histories of the cases referred to in this contribution have been frequently left for the house officer to record. Inexperience is acountable for some of the defects in the case reports available. Furthermore it is not possible to be sure of the amount of care bestowed upon the records in some instances. As a result I have found myself obliged to put aside a certain number of the case reports because they were incomplete in regard to the various points upon which I desired to publish statistics .

times appears not to be increased. The retraction of the field would suggest, under these conditions, one of simple atrophy; but the cupping of the disc attended with the dipping of the veins about the margin of the cup are features of diagnostic import. There were one hundred and forty-four cases of Chronic Glaucoma in the series reported.

Absolute Glaucoma. There were thirteen cases of this kind. In absolute glaucoma the condition has proceeded to blindness and the ultimate results of hypertension are manifest. The symptoms now depend on the character of the initial attack; should this have been acute or subacute, the anterior ciliary vessels are large and tortuous and of a deep purplish colour. The atrophy of the conjunctiva renders them conspicuous. The cornea is hazy, its epithelium may be thick, and raised into blebs or bullæ; anæsthesia of the cornea may also be noted. The iris will frequently be detected with difficulty, owing to its extreme dilatation. The individual sphincter fibres cannot be detected, and its root may at times be clearly seen to be in direct contact with the cornea at the filtration angle. Discolouration of the iris is also a feature dependent on an exfoliation of its endothelial cells and the atrophic changes in its fibres. Large engorged vessels may also be seen in the iris. The lens which was clear during the earlier manifestations of the disease may now be cataractous, the dense white or yellowish colour suggesting advanced disease of the ciliary body. Visual sensation may not be infrequent for some time after the eye is blind.

In a case of absolute glaucoma which has run a chronic course from its incipiency, the external appearances may be but little altered; the diagnosis is established by noting the hardness of the eyeball, excavation of the disc, atrophy of the optic nerve and blindness. Pain and congestion are other conditions which generally ensue. Finally, changes may occur in the size and shape of a globe owing to its tunics becoming thin and distended, and the conjunctiva atrophied. The circumscribed thinning of the sclera in the neighbourhood of the ciliary body may replace an actual generalized distension of the globe, and this local rarefication of the tissue at a definite point has been known to account for a rupture of the globe after such reflex spasms as coughing, sneezing, or of violent contraction of the lids. As one would expect, hæmorrhages and shrinkage of the globe are the result; the cornea contracts, buckling of the globe at the insertion of the extraocular muscles may be simulated and a small atrophic eye remains. Yet even in such an eye there may be a relapse of pain and inflammation

with the occurrence of a perforated ulcer of the cornea through which necrosed tissue is expelled from the contents of the globe. This, with attendant hæmorrhages, marks the exitus of such an eye.

4. Symptoms.

The first observation of importance in a case of glaucoma is that of *tension*. The method of registering tension in common practice is that of having the patient look down, and requesting him to close the eyes gently while the two fore-fingers are lightly pressed over the globe. The various degrees range from zero in the normal to + 3 in a case of absolute glaucoma, when the eyeball is so hard that it cannot be indented. The various degrees of hardness are indicated by + 1, + 2, + 3. This is the simplest method at our disposal, though it is liable to errors of registration.

In order to render the examination more exact the tonometer has been introduced, which can be directly impressed upon the globe and tension accurately registered without the confusion which the lid tissues necessitate. Until recently a reliable instrument, the accuracy of which could be absolutely trusted, was not in existence; but Schiötz[23] has, within the last two years, introduced one which appears to fill a long felt want to judge by Stock's[24] series of very carefully conducted experiments.

In the series which I am reporting a hypertension was recorded as follows:— + 1, 99 cases, + 2, 62 cases, + 3, 5 cases. Tension seemed normal in three cases while in thirty-one cases it was not recorded.

Ciliary Injection. The branches of the anterior ciliary vessels are engorged owing to embarrassment in the circulation of choroidal lymph through the venæ vorticosæ. The sudden elevation of pressure causes engorgement of all the external vessels with the natural œdematous changes of the tissues which they supply; such as chemosis of the conjunctiva and swelling of the lid. In an attack of less intensity, this congestion may be limited to the ciliary zone; while in the chronic form there is no apparent outward manifestation of hyperæmia beyond some enlargement of the anterior ciliary arteries and veins. The arteries become hypertrophied owing to the increased resistance to the entrance of blood into the eye and are to be distinguished from the veins by their greater tortuosity, their abrupt disappearance where they perforate the sclera, and by the necessity of using greater pressure to empty them. Injection was present in 105 cases, absent in 38, and not recorded in 57.

Pain is, as a rule, in direct ratio to the degree of injection.

When, in acute glaucoma, the sensitive ciliary processes are engorged, the most acute and excruciating pain may be the result. In the chronic form of the disease, where the rise in tension is more gradual, the sensitive peripheral nerve terminations have a little time to adapt themselves to the newly existing circumstances, but in many cases, strange to say, pain may be absolutely absent. Pain on admission was only recorded in sixty-eight of the two hundred cases. No doubt it had been present in many of the chronic cases to a varying degree, as one of the earlier manifestations.

Cloudiness of the cornea is a manifestation of an œdematous process in the stagnant circulation from the occlusion of the lymphatics which traverse the cornea. Minute drops of fluid may collect beneath the superficial corneal epithelium, or again in the substantia propria directly beneath Bowman's membrane, causing what one recognizes as steaminess of the cornea. This blurring of the cornea is unique in the rapidity of its onset and in its disappearance when once the cause of the œdema has been removed. When high pressure has been continued for a protracted length of time, the corneal epithelium may thicken or form blebs or vesicles known as keratitis bullosa. The opecity is, as a result, denser and, of course, more permanent. In the case of a glaucoma of a more gradual onset these corneal conditions are non-existent. Of the series reported, seventy-one cases showed evidence of steaminess of the cornea.

The condition of *dilatation of the iris,* which in glaucomatous eyes appears as one of the more acute manifestations, after a rapid rise in intraocular pressure, has been accounted for by a lowering of the blood supply of the iris, more particularly where this is inhibited by a turgid ciliary process pressing on the root of the iris. Stagnation may thus be accounted for, either by direct pressure of the ciliary process upon the iris vessels, or through some paresis of the terminal nerve endings of the sphincter pupillæ, which is also a disturbance due to pressure. The semi-dilated or oval pupil might suggest the engorgement of certain ciliary process more than of others. In the chronic form of the disease, where the onset has been more insidious, the pressure is raised more gradually. The vessels of the iris have time to adapt themselves for compensatory hypertrophy, and the blood supply is maintained. There is little if any pinching of the root of the iris. In such cases the pupil may dilate but very little, if at all, and if the eye of the opposite side be healthy, the pupil of the diseased eye may remain of normal size and react to consensual stimuli, even though it be blind.

The pupil was dilated in seventy-nine cases of the present series, contracted or irregular from synechiæ or other causes in forty-three cases. The balance were not recorded.

The power of accommodation is, as a rule, limited at the onset of glaucoma, due, no doubt, to the stretching of the choroid induced by the added intraocular tension, thus increasing the resistence to the contraction of the ciliary muscle, as well as to the direct pressure upon the muscle itself, which may become atrophic later on.

A shallow anterior chamber is a condition found in primary, as well as in some of the allied forms of glaucoma, for instance in that produced by neoplasmata of the choroid, or by vitreous hæmorrhages. A deepening of the anterior chamber is noted in buphthalmos. In the case of new growths in the choroid, the lens is pushed forward by the retention of fluid in the vitreous cavity, while in buphthalmous it is pushed backward by a hypersecretion in the anterior chamber. In this series, ninety-one cases showed definite shallowness of the anterior chamber.

Changes in the ocular refraction may be easily understood if one accepts the idea of a contorted or elongated globe. One case following a retinal hæmorrhage developed in a myope of 9 D. The degree of astigmatism noted in a glaucomatous eye may be partly mechanical—the result of an iridectomy. The persistent falling forward of the lens may also account for some refractive aberration.

Cupping of the optic disc is due to the continued rise of the intraocular pressure, the lamina cribrosa (the mesh-work of fibro-connective tissue which allows entrance of the optic nerve fibres) being the point of least resistance in the adult eye. The nerve fibres as well as the veins are pushed back, the firm scleral ring supporting the nerve head resists the insult and shows up in marked contrast to the excavated part of the disc. (Figs. 22, 23). The nerve fibres are bent and stretched over the fixed margin and atrophy, resulting in a distinct undermined edge of the cup. Cupping results only after the glaucomatous process has been in existence for some little time. On examining the disc by the indirect method by means of the ophthalmoscope, the vessels about the disc seem to have a little more definite movement than those at the bottom of the cup, when the position of the lens is changed. Of course, in the direct method of examination, relative difference in their refractive appearance can be noted at once, cupping being measured as one would register a swelling of the disc in millimeters

or dioptres. As a rule the cribriform plate is paler in glaucoma than is the normal disc and its sievelike arrangement is more accentuated, owing to atrophy of the nerve fibres. The sides of the cup are, to a certain degree, hidden by the overhanging margins in such a way that the vessels, more particularly the veins, visible at the bottom of the cup, are lost as they course to the sides, reappearing altered in number and position, and constituting what is regarded clinically as "dipping" before they gain the retinal surface. The vessels have a tendency to be displaced to the nasal side. (Fig. 23.) There may be a zone of lighter color about the margin of the disc the result of a circumscribed choroidal atrophy. A posterior staphyloma may give one the impression of the disc appearing larger than normal and may cause one to misinterpret the condition owing to the relatively straight course of the vessels.

Contrasted with the physiological cupping of the healthy disc, one notices that the glaucomatous cupping occupies practically the whole of the surface of the disc, and further that in the physiological cup, the course of the vessels is straight. In early cases, however, these differences may not easily be detected, and an early primary atrophy of an eye with a well marked physiological cupping may only be mentioned as an instance of a possible error in diagnosis (Schweigger). Cupping of the disc was only recorded in sixty-five cases of my series. The difficulty which we have all experienced in the use of the ophthalmoscope as junior house surgeons has, no doubt, accounted for a great many omissions; on the other hand, the presence of corneal opacities, synechiæ, exudates in the anterior as well as in the vitreous chamber, and cataractous changes are a number of features which inhibited a satisfactory view of the disc and vessels in a great many cases.

Impairment of Vision. This may be due to a multiplicity of factors, but is primarily due to pressure. The initial œdema of the cornea causes a dimness of vision in the day time and luminous coloured rims occur about the lights at night. A flame may appear normally clear and about it is a clear zone followed by rims of colours which include the whole spectrum, the violet being invariably the inner and the red the outer. Refracting lenses do not appear to alter the position or arrangement of the colours, nor do the colours seem to be changed by the size of the pupil. It is detected in direct vision, as well as when the image falls upon parts of the retina other than the blind spot. Treacher Collins[15] has shown that this condition is due to an œdema of the surface epithelium of the cornea by the experimental use of a weak solution of hydr-chlorate

of erythrophleine, which produces a slight haze and anæsthesia of the cornea, blurring of vision, and the appearance of rings or colours about a flame with the same arrangement as in glaucoma. The experimenter associated the phenomenon with definite disturbance in the corneal epithelium and demonstrated thatit was not necessarily due to an excess of pressure in the chambers. It follows that the presence of rings of colours may not necessarily mean the onset of glaucoma.

Visual Field. To understand the variations of the visual field, one must appreciate the lowering of the retinal circulation which attends a rapid onset of high intraocular pressure. Priestley Smith has shown that in the healthy eye one may abolish the whole of a peripheral field of vision by external pressure upon the globe. He considers it to be due to a circulatory disturbance in the retina, and possibly also in the choroidal vessels which nourish the perceptive layers. Some effect may also be produced by direct compression upon nervous structures. In simple chronic glaucoma the gradual rise in intraocular pressure causes a different form of retinal paralysis. For a time, the centre of the field may retain approximately normal vision, while a limitation of the peripheral field is marked, or emphasized, on examination. Diminution of the field in its most typical form begins at the nasal side, involving the upper and lower segments, before the temporal side is involved. The sentient area is gradually reduced to a sector extending outward from the fixation point and the area about it, leaving but a small eccentric area extending outward beyond the blind spot, corresponding to a small portion of retina on the nasal side of the disc. Finally, this portion is also involved. Doubtless there is progressive involvement of the nerve fibres in the cupped disc, those belonging to the temporal side of the retina manifesting changes earlier than those which belong to the nasal half, those passing to the periphery earlier than those supplying the macula. Thus, preservation of good central vision, even when contraction is highly advanced, is proof that the retinal circulation is well maintained as compared with the condition in acute glaucoma. Bunge, in a report on the examination of one hundred cases, shows the atrophy to involve chiefly the nasal side in the very large proportion af cases. There are, however, some exceptions to the general rule, as his tabulation demonstrates:

Defect on nasal side only	27
Predominating on nasal side	44
Loss of whole field except peri-papillary oval	4

Loss of whole field including fixation point, but excepting small temporal area	9
Central or para-central scotoma, with or without slight restriction of nasal periphery	4
Restriction upward only (atypical form)	2
Concentric restriction (atypical form)	6
Preponderance of defect in temporal field (atypical form)	4

Since the introduction of Bjerrum's perimeter, primary defects come to be detected which frequently escaped notice with the ordinary revolving arc perimeter. Two types of retinal paralysis may frequently be combined; an acute glaucoma may introduce loss of vision by increasing the circulation, prolonged pressure completing it by excavating the disc. The loss due to atrophy of the nerve fibres is irreparable, although the timely removal of the cause inducing heightened pressure will assist in restoring what is lost through recent obstruction in the retinal circulation.

5. Pathology.

From a study of the histological structure and physiological function of the ciliary processes, we are led to believe that they supply fluid which nourishes the vitreous and lens and replenishes the anterior chamber. (Figs. 1, 2.) This fluid passes forward through the pupil into the anterior chamber and escapes from thence through the ligamentum pectinatum (according to the opinion of many) through the spaces of Fontana (as is generally agreed), and thence through the canal of Schlemm which connects with the venæ vorticosæ. Devries[30] has recently demonstrated that a smaller, though an appreciable amount, passes back through the vitreous chamber, to escape, probably, by way of the perivascular spaces of the optic disc.

Primary Glaucoma. In looking for a primary cause for glaucoma, one recognizes the fact that the fluids of the vitreous and aqueous are chemically of almost identical composition, each containing an almost inestimable trace of albumen. It has been demonstrated that after performing a paracentesis of the cornea, the resecreted aqueous contains considerable albumen, due apparently to the fact that with the lowering of intraocular pressure there is dilatation of the capillaries of the ciliary body, whose secreting epithelium fails in its selective action, and the albuminous constituents of the blood, in consequence, exude. In like manner,

in inflammatory conditions of the ciliary body, its secretion is highly albuminous, and this change in composition plays a most important rôle in the production of glaucoma. That this is so has been emphatically brought to our attention by Martin Fischer[33] in his recent work on œdema. This writer takes an independent attitude to that adopted by most of the recognized authorities on ophthalmology and says that the cause of glaucoma may well reside in the tissue of the eye itself and that it becomes glaucomatous not because fluid is forced into it, but because, through changes in the tissues, it absorbs an increased amount of water. He asserts that the amount of such absorption is sufficient to explain the severest grades of glaucoma ever observed clinically. This is demonstrated experimentally by the fact that, through the mere presence of a little acid, an ox's eye may be made to absorb sufficient water to rupture its intensely thick sclera. Fischer's experiments show that the increased absorption of water by the eye is dependent upon the ocular colloids; for not only is the eye built up of a series of colloids (the sclera, cornea, lens and vitreous), but the same conditions which govern the absorption of water by fibrin also gvern the absorption of water by the eye. Chemical changes occur within the eye which increase the affinity of the ocular colloids for water so that they are enabled to absorb water from any available source. In his experiments with enucleated eyes this source has been the solution into which the eyes have been dropped; in the body, it is the fluids floating about or through the eye.

Just what these chemical changes are, the author is unprepared to state definitely; yet he has little doubt that the cause of the œdema is, in essence, the same as in any of the generalized forms. In a large number of cases of glaucoma, circulatory disturbances in the eye are unquestionably present which permit of an accumulation of carbon dioxide and the abnormal development of such acids as are a constant accompaniment of states of lack of oxygen. In conditions of glaucoma due to infection, or more definitely to toxic agencies capable of producing inflammatory changes in the strict pathological sense of the term, one has to look to the chemical changes induced by these for the cause of the altered affinity of the ocular colloids for water. Fischer's theory is supported by a series of scientifically accurate experiments.

Thompson Henderson[28] lays particular emphasis on the crypts of the iris (Fuchs[25]) as a primary focus of inhibition. An absorptive power, according to this author, is present in the iris by means of crypts which allow the aqueous direct access to the iris veins.

He has demonstrated that the venous sinus of Schlemm's canal is formed by tributaries from the whole of the anterior portion of the uveal tract. Blockage or sclerosis of these crypts is held as primarily responsible for the glaucomatous state, *to which he is, however, careful to add the factor of a sclerosed cribriform ligament.* Dilatation of the pupil with sclerosis of the cribriform ligament closes the iris crypts and thus obstructs the only remaining venous outlet. A heightened arterial pressure brings more blood to the eye, and produces venous compression. The latter, in its turn, implies an increased volume of venous blood in an eye whose absorptive power is already reduced to a minimum.—A vicious circle is thus started. The difference between chronic, non-congestive and acute glaucoma is frequently interpreted as one of degree and not of kind. *The whole of the uveal tract is associated* with the rise in intraocular tension in producing congestion and œdema. The extent of the occlusion of the filtration angle depends directly upon congestive œdema of the iris, because its base is first applied against and then adherent to the posterior surface of the cornea. Henderson considers the forward displacement of the ciliary processes to be not a cause but a result of the adhesion of the iris to the posterior surface of the cornea. He further states that the shallowing of the anterior chamber is another manifestation of acute congestive œdema of the uvea and results from the slackening of the zonular fibres and a consequent prolapse of the lens, depending on the swelling of the orbicularis ciliaris.

Schreiber and Wengler[31] have reproduced the experiments of Erdman in a modified way. When iron is injected into the anterior chamber of rabbits the filtration angle becomes obliterated in the majority of cases. With this there is an increase in intraocular tension, an increase in the size of the globe, and an apparent deepening of the anterior chamber. Although the retina of the rabbit allows of considerable stretching without a great deal of damage being done, when the stretching is sudden, a rapid degeneration of the ganglion cells and nerve fibres takes place, which spreads into the optic tracts in three weeks' time. Assuming that the tension remains approximately constant, an association of increase in the size of the globe with stretching of the retina would appear to protect against degeneration. Increased pressure, which is an accompaniment of the increase of size of the globe, suffices to cause a deepening and broadening of the physiological cup.

In dogs, the injection of iron does not produce hydrophthalmos, but a secondary glaucoma, due to the closure of the filtration angle,

seclusio et occlusio pupillae and complete obliteration of the anterior chamber. The globe enlarges more in dogs than in rabbits. A simultaneous detachment of the retina occurred in most cases, an excavation of the papilla did not occur.

All these results hardly maintain the theories regarding the glaucomatous excavation as advanced by Schnabel[16] and Elschnig.[18]

The histological investigations of Levinson[29] upon eyes affected by primary glaucoma demonstrate an infiltration of pigment at the filtration angle, about what he understands as the pectinate ligament, forming a series of minute anterior synechiae. This pigment is not haematogenous, but originates from the pigment epithelium of the iris and ciliary processes. This elicits an accumulation of leucocytes which imbibe the pigment particles and carry them partly into the circulation and partly into the anterior surface of the iris. This pigment is very resistant to pressure and remains intact, even in old cases with atrophic irides, except at the ciliary portion. Levinson would associate a hypertrophy of the connective tissue of Müller's muscle and the ciliary processes with the alteration of the pigment epithelium. This hypertrophy damages the adjacent pigment epithelium not only by trophic action, but also mechanically by pressing the ciliary processes upon the posterior surface of the iris. This hypertrophy produces a dislocation of the sagittal edge of the ciliary body and the root of the iris, so that the anterior chamber is narrowed. Increase in pressure results in atrophic changes in the ciliary muscle. The dilator pupillae is especially resistant; it seems indeed to undergo hypertrophy and produce the intense degree of mydriasis seen in absolute glaucoma. The clinical findings in the prodromal stages indicate a disturbance in the ciliary body, for there is a decrease in the power of accommodation. Such clinical signs as stagnation of fluid, hyperaemia, sensitiveness to pressure and great pain as met with in an attack of acute glaucoma are best explained by a sudden hindrance in the current of the intraocular fluids. An obstruction of the spaces of Fontana causes not only primary, but frequently secondary glaucoma as well, as demonstrated by serous iritis, swelling of the lens, discision of secondary caratact, plastic irido-cyclitis, dislocation of the lens, and intraocular tumours. Levinson's anatomical investigations showed the obstruction to be due to swollen lens substance, vitreous humour, pus corpuscles, fibrin, and pigment cells. He recognized further that other causes than infiltration of the spaces of Fontana may cause glaucoma, but he failed

to induce glaucoma in cats by injecting uveal pigment (triturated in aqueous humour) into the anterior chamber.

The filtration angle is closed in the large majority of glaucoma cases; when not actually closed, it shows some evidence of compression. (Figs. 3, 4, 5.) In early cases, the base of the iris is merely pinched against the cornea, while in the more chronic forms of the disease the iris is generally actually adherent to the lower strata of the cornea. The iris is also atrophied. The adhesions at the filtration angle may be extensive or they may be almost indeterminable. In recent cases the ciliary body is hypertrophied and engorged and shows signs of having been strangulated between the iris and the lens, the latter pushing the former against the cornea and obliterating the filtration angle. (Fig. 6.) In cases of long standing these ciliary processes are atrophied and retracted, but, as Priestley-Smith points out, there may be any number of degrees between extreme hypertrophy and shrinking. The condition of the ciliary muscle corresponds to that of the ciliary body itself, being either hypertrophied or atrophied. The lens is said usually to lie nearer the cornea than is the case in the normal eye, for it is frequently in close contact with the iris and ciliary processes. Further, in many cases, particularly in hypermetropic eyes, there seems to be disproportion between the lens and the globe which contains it. These two conditions, a hypertrophied ciliary body and a proportionately larger lens, exert an additional element of pressure on the root of the iris, thus becoming factors in the process of retention. The underlying initial causes of such conditions, are, as already suggested, usually disturbances of the circulation which congest the internal vessels of the eye. The predisposition depends upon structural peculiarities or changes in the eye which, in Priestley-Smith's opinion, bring the lens into closer relationship than usual with the parts about it.

Some of the numerous conditions which disturb the circulation and induce a venous engorgement and directly tend to promote a primary glaucomatous attack are exposure to cold and dampness, fatigue, hunger, nervous depression and constipation. This congestion is frequently evidenced by a fullness of the temporal veins. That a mild attack may be averted, at least temporarily, by eliminating these excitants and by the substitution of their antitheses, proves that intraocular equilibrium can be re-established by the reduction of congestion or of turgidity, so that the turgid ciliary processes no longer press upon the lens and indirectly upon the root of the iris, and thus remove the blockage at the filtration angle.

In a severe attack of acute glaucoma the congestion proceeds to an actual oedema without the usual evidences of an inflammatory process, in that there appears to be but little plastic exudate associated, and in that the form of inflammation never proceeds to suppuration. An acute glaucoma has been aptly compared to the process of engorgement, or circulatory stagnation, exemplified by strangulated hernia, the circulation only being re-established by the removal of the parts primarily inducing pressure.

Although some authors consider that the onset of an acute glaucomatous attack is dependent on the condition of the vessels, yet this can scarcely be admitted as coming under the classification of a primary etiological factor. Thrombosis, small hemorrhages, or other exudates in the anterior chamber are conditions the detection of which is frequently beset with many difficulties, and if they be present in the vitreous cavity they may escape detection. (Fig. 7.) Birnbacher and Czermak[12] tell us that occlusion of the venae vorticosae would be an etiological factor, but Priestley-Smith's microscopical studies of a series of glaucomatous eyes do not bear out this view.

My own pathological experience makes me adopt an independent interpretation regarding conditions about the filtration angle. Feeling that much is to be learned from a careful examination and comparison of the eyes of the lower animals, in which glaucoma has never been shown to exist, I have made sections from the eye of the newborn infant, four months' human foetus, guinea pig, white rabbit, colored rabbit, white rat, frog and pig, and have carefully studied the structures in and about the filtration angle. My conclusion, after a microscopic examination of these lower forms, is that the ligamentum pectinatum must be regarded as a factor in the obliteration of the filtration angle to only a modified degree. In the lower forms which I have examined, in the frog, or even in the pig (Figs. 8, 9), whose ocular anatomy in many respects resembles that of man, the pectinate ligament is situated well forward from the angle, leaving a well defined space between it and the spaces of Fontana, a space which one could imagine might be at least partly maintained should a heightened intraocular tension press against the root of the iris. In man, in my opinion, the pectinate ligament does not exist even in a non-glaucomatous eye. At most, it might persist in an atrophied form. If atrophied, it would lie almost in direct contact with the actual root of the iris, and completely occlude the entrance of the aqueous so soon

as hypertension brought the atrophied or shrunken ligament and the other tissues about the filtration angle closer together.

The investigations of Rochon-Dauvignaud[13] considerably support this interpretation. This author states that there exist at the filtration angle two trabecular systems, a sclero-corneal, and a cilio-scleral, the latter connecting the former to the root of the iris and to the ciliary body. According to this author, the cilio-scleral system of mammals and birds is formed of large pigmented trabeculae and deserves the name of ligamentum pectinatum. Conditions are quite different in the apes and man. The fœtus possesses a pectinate ligament in every way analogous to the quadrupeds, but it does not appear to persist after birth and the adult man possesses but the sclero-corneal spaces which form a network between the canal of Schlemm and the anterior chamber. He further points out that in the monkey, as in man, the ciliary muscle is sufficiently well developed to be alone responsible for close apposition of the two vascular membrances, the iris and the ciliary processes, to the fibrous or corneo-scleral structure. The ligamentum pectinatum has atrophied in consequence.

Priestley-Smith attributes definite importance to the continued development of the lens in a globe which has obtained its full size at puberty, in that the continued increase in size of the lens compresses and causes engorgement of the ciliary processes; these processes then press forward upon the root of the iris and the filtration angle. At first sight this theory seems acceptable, but one's observations on the lower animals, such as the frog and guinea pig, are opposed to the theory, because here the crystalline lens is relatively of a very much larger size than in the human at any age. In the white rat the lens is seen to occupy practically the whole of the vitreous cavity. (Fig. 10.) It seems more likely that the senile atrophic changes in fibro-connective tissue elements in elderly persons renders the suspensory ligament friable and causes forward dislocation of the lens and consequent pressure upon the anterior ciliary process and the root of the iris.

The shallow anterior chamber so frequently met with in this morbid process does not, of necessity, indicate an actual displacement of the lens, for the chamber is normally shallow in old age, probably because the loss of inherent elasticity in the crystalline has increased its thickness. In many cases of the acute variety, however, actual displacement of the lens does occur, and deepening of the chamber takes place after the attack subsides. One knows that in the normal eye any excess of fluid in the vitreous

may escape by the anterior chamber, as has been noted in cases of the development of choroidal neoplasmata prior to displacement of the lens. It would appear, therefore, that in primary glaucoma there must be some impediment in the circulation from the vitreous to the aqueous chamber, some alteration in the hyaloid membrane, or some change in the vitreous itself. The hyaloid membrane of the vitreous may be thickened or coated by albuminous coagulum.

In some cases it has been noted that the space about the lens, known as the posterior chamber, impedes the intraocular circulation. This is the result of engorgement or turgidity of the ciliary process produced by their compression between the lens and the iris; the secreted fluid of these processes is, in consequence, unable to escape. Such penalties of old age as vaso/motor and sclerotic alterations in the arterial walls of the tissues about the filtration angle, and the deposit of pigment which is so frequently associated with arteriosclerotic change in uveal tissue, are etiological factors in the production of glaucoma in the aged.

It has been noted in a number of instances that small eyes, evidenced by a corneal diameter under 10 mm., are particularly susceptible to glaucomatous changes. The explanation is that the cornea and sclera on which the smallness of the eye depends, originate from the mesoderm. The lens, on the other hand, being of epiblastic origin, is formed by the ectoderm, and may reasonably be expected to progress in development even though the mesodermal elements may have been retarded in growth. The fact that the reverse could hold good, would have no particular bearing on the question under consideration.

Measurements of the Eye.. The observations which I have made are as follows:

	Globe			
	Horizontal	Antero-posterior	Cornea	Lens
New-born infant	14.75	17.00	7.75	5.00 x 4.5
Guinea-pig	6.75	5.00	3.50	1.75 x 1.5
Rabbit	15.50	18.00	16.00	8.00 x 6.5
Pig	25.00	21.00	15.00	9.00 x 7.5
White rat	4.00	4.50	3.25	3.00 x 3.0
Frog	8.00	6.50	5.00	3.75 x 3.0
Human, healthy	25.00	25.00	12.00	8.75 x 6.0
Human (glaucoma)	22.00	21.75	10.00	9.00 x 6.5

The above figures alone, quite apart from consideration of other structural features of the eyeball, are not in accordance with the view that the proportionate increase in measurement of the human lens in glaucomatous eyes as compared with the healthy eye, is of

itself responsible for the increase of tension and for the subsequent course of the disease.

Priestley-Smith believes that the influence of *heredity* is no more than a question of congenital smallness of eye and is not a direct factor. Lawford quotes a case upon which he operated where the condition had existed in three generations and refers to other cases in two generations described by Lucien Howe, Nettleship and Jacobson.

The question of *racial predisposition* is as yet undetermined, although some writers state that the Jewish people are predisposed to the disease.

Hypermetropia. Hypermetropic eyes are structurally predisposed to the disease, only when the anterior chamber is shallow and the ciliary processes more prominent, because of the hypertrophy of the ciliary muscle produced by the extra accommodative effort. Such a strain induces a narrower filtration angle. An illustration of this fact has recently been brought to our notice at the Out Patient Department of the Royal Victoria Hospital. A single disc of homatropine (gr. 1-40) was put in each eye of a woman of 47 years of age prior to estimation of error of refraction. One eye was slightly myopic, the other hypermetropic. An intense glaucoma of the acute variety manifesting all the classical symptoms of the disease appeared in the hypermetropic eye the day following, while the myopic eye was not affected. The condition readily yielded to the energetic use of eserine. On the other hand, a case of extreme absolute glaucoma of the haemorrhagic type, which necessitated a subsequent enucleation of the globe, occurred in a myope of 7 D. (Fig. 11).

Regarding the predisposition of the *sexes,* some authorities claim that the disease is more frequently met with in females than in males. This they attribute to the greater instability of the vasomotor system indicated by the vascular disturbances relating to the organs of generation. Other writers do not pay any particular attention to this disproportion. In the present series there was hardly an appreciable inequality in numbers, the disease occurring in one hundred and two males and in ninety-eight females. The right eye was affected in ninety-three cases and the left in one hundred and three, while in four cases the particular eye was not specified.

Age. The disease would appear to be most common between sixty and seventy years. My tabulation of ages is as follows:

0	20 years	8 Cases
20	30 "	8 "
30	40 "	21 "
40	50 "	36 "
50	60 "	30 "
60	70 "	61 "
70	80 "	22 "
80	90 "	2 "
Not stated		12 "

Secondary Glaucoma. Repeated attacks of iritis with the formation of synechiae which, either from ignorance or negligence, have been allowed to proceed unchecked, are definitely responsible for the prodromal symptoms of a glaucoma (Fig. 12.) An annular or complete synechia about the pupillary margin attaching it to the anterior lens capsule, inhibits the circulation of the secreted aqueous from the posterior to the anterior chamber and the canal of Schlemm. With the inevitable bulging forward of the iris its endothelial layer at the root is brought to lie in direct contact with Descemet's membrane, consequently shutting off the lymph channel at the angle of secretion. Such conditions should be anticipated by the intelligent surgeon and overcome by an iridectomy before pain, injection, increased tension, and loss of vision make their appearance. Cases of this sort, which have been allowed to proceed to total blindness, may require an enucleation of the eyeball for the ultimate relief of pain.

Priestley Smith observes that in such blind eyes a separation of the retina occurs, and that they may often soften and shrink because secretion of the aqueous through the atrophied ciliary bodies has ceased.

Serous Iridocyclitis. A thick albuminous secretion is thrown out in these forms of inflammation, and escapes from the anterior chamber at the filtration angle much less readily than does the normal aqueous solution. This albuminous fluid consists largely of lymphocytes, and these are frequently found dotted over the endothelial layer of Descemet's membrane as tiny grey dots which can readily be detected with the ordinary loupe. These dots have improperly been termed by English and American writers, "keratitis punctata;" the cornea is, however, in no way involved, as is proven by the fact that the pigment granules of the uveal tissue accompany the lymphocytes. The round cells are broken up later and are partially absorbed while the residual pigment

granules act as the principal factor ii blocking the filtration angle (Fig. 7).

Perforating Wounds and Ulcers of the Cornea. With perforation of the cornea and subsequent escape of the aqueous, prolapse of the iris occurs which fastens itself at the point of perforation. So long as the wound is occupied only by granulation tissue the eye remains soft; but when scar tissue is laid down in the corneal reparative process a sufficient outlet to the aqueous is not allowed. The lens may also be thrown forward, which is an additional impediment to the circulation of the aqueous. Should part of the lens be involved in the corneal cicatrix either as lens matter, or still more likely as lens capsule, the filtration process may also be prevented. Cases of buphthalmos, as the result of perforated ulceration of the cornea following an ophthalmia neonatorum, will participate in the same pathological process, the iris falling forward on the thin cornea in its mechanical attempts to prevent infection of the deeper tissues of the globe. The pathology of this factor I have already referred to in an earlier communication (*Ophthalmic Record* August, 1908.) (Figs. 13, 14, 15.)

Cataract Operations. Glaucoma following an operation for the extraction of cataract is a question of serious importance. After an apparently successful operation symptoms may arise during the after treatment or perhaps months after an apparently satisfactory result. The consensus of opinion is that the root of the iris becomes included in the corneal wound, and for this reason the simple extraction of the lens without an iridectomy has been practically abandoned. Another point which I have already dwelt upon is the advisability of removing the anterior capsule with forceps rather than merely puncturing it with the cystotome in order to avoid the possibility of an inclusion of the capsule in the corneal incision. (Fig. 16.) Treacher Collins, reports ten cases of post-cataractous glaucoma, and in nine the capsule was adherent to the scar, while the hyaloid membrane was adherent in the tenth case. The aim of the operator in a case of cataract should be to obtain a free filtration angle and an open pupil. This may be subsequently effected by puncturing or perforating the pupillary membrane with a Knapp's needle; or a sclerotomy freeing the filtration may afford even better results. The sudden swelling of the lens after needling a lamellar cataract or myopic lens may induce symptoms of an acute glaucoma by pressure upon the iris, or by aggregating unabsorbed lens matter in the filtration angle. Again, the post operative irritation in the iris and ciliary body set up by

a needling, may produce posterior synechiae which, as I have already stated, may bring about glaucomatous symptoms; but this may be avoided by a timely iridectomy. A spontaneous or other dislocation of the lens forward inot the anterior chambers will also invariably induce glaucoma. Should glaucoma not be present, however, one may be satisfied that exit of the aqueous through the pupil has not been completely blocked.

In lateral dislocation of the lens, contusion of the globe with other symptoms of glaucoma, one notices an unequal dilatation of the pupil, the segment least dilated lying in close apposition to the posterior surface of the cornea. Behind the more dilated segment of iris one is able to distinguish the margin of the dislocated lens with the ophthalmoscope, rupture of the suspensory ligament having occurred.

Intraocular Tumors. Sarcomata of the choroid in their later stages almost invariably lead to glaucomatous manifestations and should the media be blurred, an ophthalmoscopic examination would suggest a diagnosis of the acute primary variety. The onset of the glaucomatous symptoms is synchronous with the displacement forward of the lens and iris by the tumour mass, and the attendant blocking of the filtration angle. (Figs. 17, 18.) Yet direct pressure of the sarcoma is not exerted on these structures, for it may actually be far removed from them. A choroidal venous engorgement results in an extravasation of serum, induces a retinal detachment forward and inward upon the vitreous. At first there is not appreciable rise of tension, and some of the vitreous fluid is accommodated through the hyaloid into the anterior chamber. Later, when separation of the retina has become complete and has assumed a "T" or umbrella form along the meridian line of the globe, further compensation is rendered impossible; the lens, ciliary processes, and iris are pressed forward by the oedematous effusion existing in the choroid behind, the filtration angle is closed or jammed and the glaucomatous process is established. (Fuchs.)

Glioma of the retina will induce glaucoma in a similar manner while neoplasmata at the root of the iris will occasionally encourage glaucomatous attacks by directly blocking the filtration angle.

Intraocular Haemorrhage. This is occasionally the starting point of a rise in tension, notably in eyes where partial separation of the retina has been present and where tension up to the onset of the hæmorrhage has been subnormal. Coloboma iridis and aniridia may induce a glaucoma by the presence of the small rudimentary nodule which represents the iris at the filtration angles.

Congenital Buphthalmos. This depends upon the peripheral adhesion of the iris and cornea, a failure in separation of these tissues probably being due to a fault of development rather than to disease as Treacher Collins has pointed out. The enlargement of the eye is due to the increase in the intraocular pressure.

6. Treatment.

It has been impossible for us to obtain a satisfactory record of the results of treatment in all cases. The patients in our series frequently left hospital at a comparatively short time after primary healing of the various operative procedures had taken place, before one could determine any positive or actual results. A large number, if not the majority of patients, came from various parts of Canada as well as from the neighboring States and they naturally could not return to hospital at a distant date after discharge in order to furnish exact information regarding their subsequent visual acuity.

Care was naturally taken of the patients' general hygiene and all depressing influences were avoided. Myotics were employed alone in twenty-one cases. Sclerotomy was performed nine times, while an iridectomy was done in ninety-seven cases. In twenty instances the globe was enucleated on account of pain, or when a conditions of glaucoma was induced by the presence of an intraocular tumour. In one of this last mentioned cases of enucleation, a Jonesco's operation had previously been performed and the result in this unfortunate instance seemed to warrant Herbert Parson's[19] verdict on the operation: "Extirpation of the ciliary and superior cervical ganglia have been performed upon wholly insufficient grounds and the results are not of a nature to encourage a repetition of the experiments."

In a fair proportion of cases where surgical as well as medical intervention was undertaken, satisfactory results followed, more especially in the acute cases. But it is only right and just to record that in a proportion of cases, unfortunately all too large, the classical iridectomy would not eliminate the progress of the disorder. (Figs. 19, 20.)

The recent operative procedures of establishing a communication between the anterior chamber and the conjunctival capillaries by means of a cystoid cicatrix as practised by Lagrange,[32] Elliott,[34] and Herbert[22] (Fig. 21), appear as a long expected ray of hope for those whose outlook is to sit in darkness, as well as to those in whose care their eyesight is entrusted. Time alone must tell what the future has in store for this unfortunate class of patients, and

reports of these several operations will be looked for with the keenest expectancy.

In conclusion I should like to express my sincere thanks to Dr. J. W. Stirling and to Dr. W. G. M. Byers for the absolute freedom and encouragement they have afforded me throughout my work, as well as for supplying me with much of the material from which I have prepared my pathological sections. I am also indebted to Mr. Herbert Parsons and to Mr. Hudson, of the Royal London Ophthalmic Hospital, for two microscopic sections illustrating an iridectomy, to Dr. John MacMillan, who has borne much of the heat and burden of the work in assisting me with the least interesting and most tedious part of this contribution, the compilation of the statistics, and to Dr. Gruner for the assistance and advice which he has always been most ready to give me.

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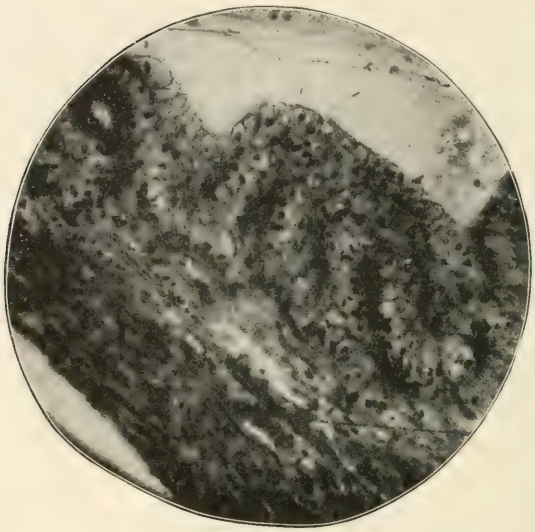

FIG. 1.

L. Fibres of Suspensory Ligament of Lens.
R. Pars Ciliaris Retinæ.
P. Large cuboid cells, depigmented.
V. Blood Vessel.
M. Ciliary Muscle.

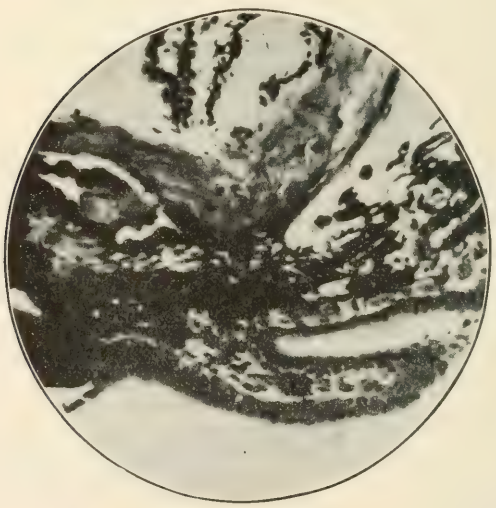

FIG. 2.—Structure of solitary Ciliary Process as seen in the Frog. As seen from above down: corneal epithelium, substantia propria corneæ and Descemet's membrane, Anterior Chamber, Iris, Posterior Chamber and Ciliary Process.

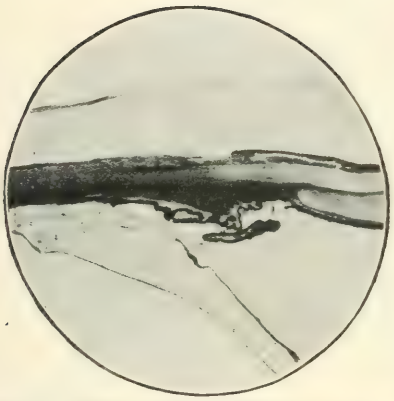

FIG. 3.—Obliteration of Filtration Angle in Chronic Simple Glaucoma.

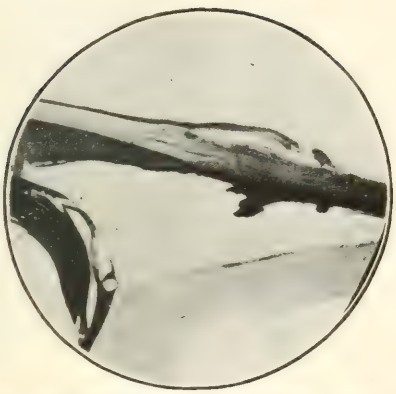

FIG. 4.—Occlusion of Filtration Angle in Chronic Primary Glaucoma.

FIG. 5.—Obliteration of Filtration Angle in case of simple Primary Glaucoma.

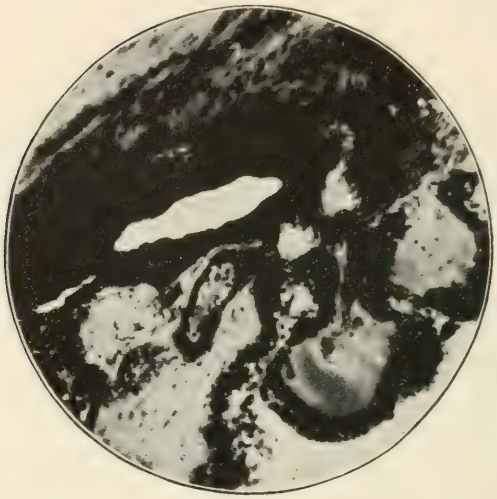

FIG. 6.—Enormous engorged Anterior Ciliary Process in contact with root of Iris pressing it directly against Cornea, completely shutting off Filtration Angle.

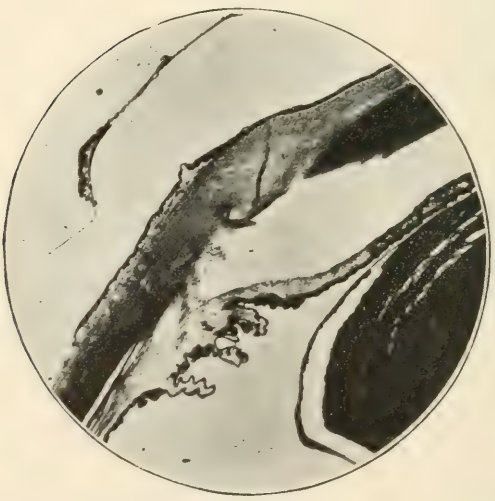

FIG. 7.—Apparent deepening of Anterior Chamber and Filtration Angle in extreme case of Glaucoma. Canal of Schlem and Filtration Angle blocked by lymph exudate, debris, and pigment cells.

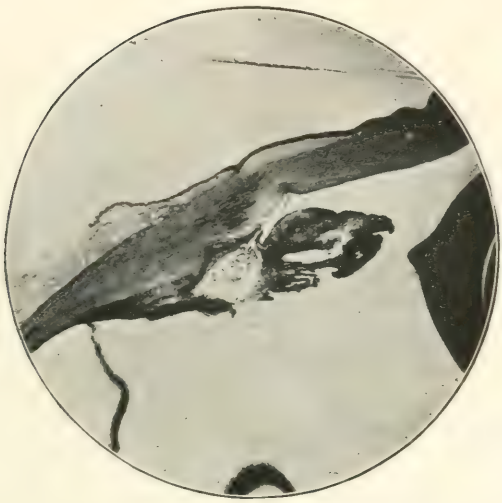

FIG. 8.—Structures about Filtration Angle as seen in Pig. Dense fibrous bands extending from anterior surface of thickened Iris to Descemet's Membrane, internal to Canal of Schlem—Pectinate Ligament.

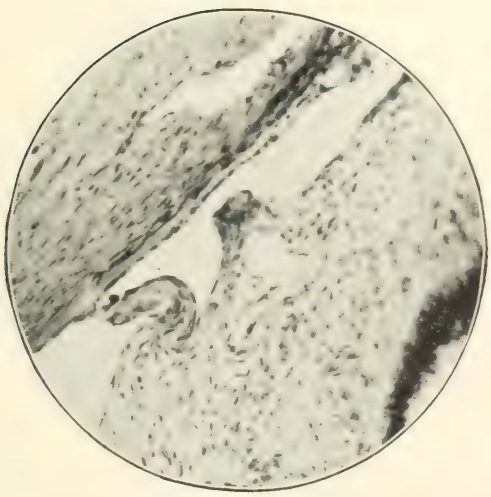

FIG. 9.—Fibres of Pectinate Ligament as seen at Filtration Angle in eye of Pig, extending from endothelial layer of Iris to Descemet's Membrane.

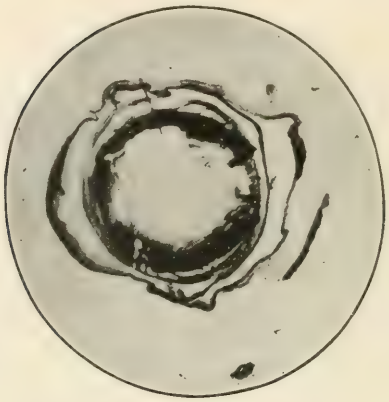

FIG. 10.—Eye of White Rat showing Lens occupying practically the whole of the interior of the Globe. No diminution in depth of Anterior Chamber or of Filtration Angle.

FIG. 11.—Optic Nerve in case of Hæmorrhagic Glaucoma. Extensive choroidal hæmorrhages with complete separation of the Retina, which partly occupies a characteristically cupped Optic Disc.

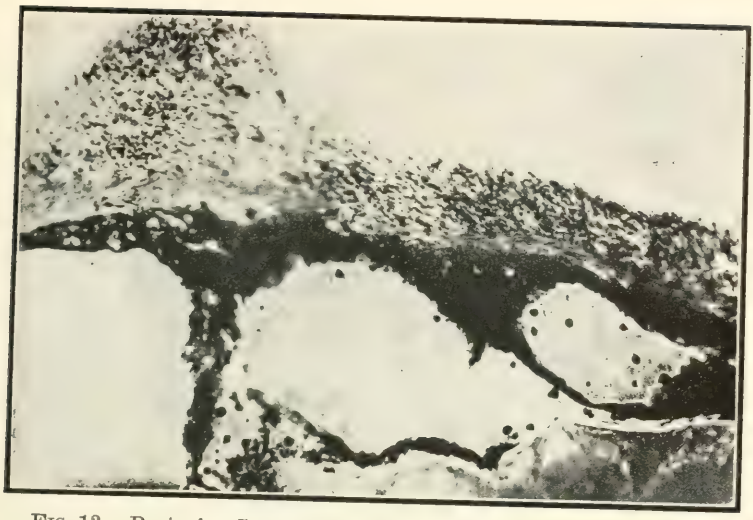

FIG. 12.—Posterior Synechiæ extending from pigment layer of Iris to anterior Lens Capsule.

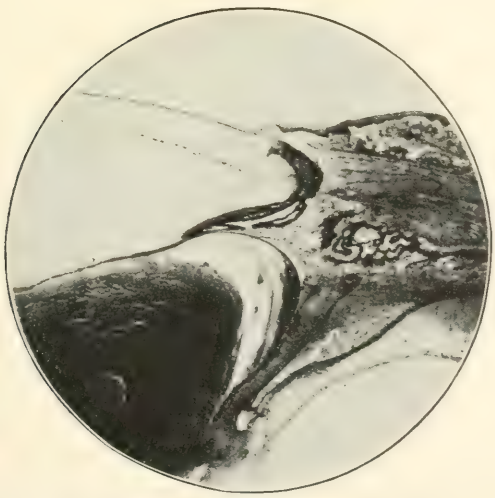

FIG. 13.—Perforating Wound of Cornea near Corneo-Schleral Margin. Inclusion of Root of Iris shutting off Filtration Angle.

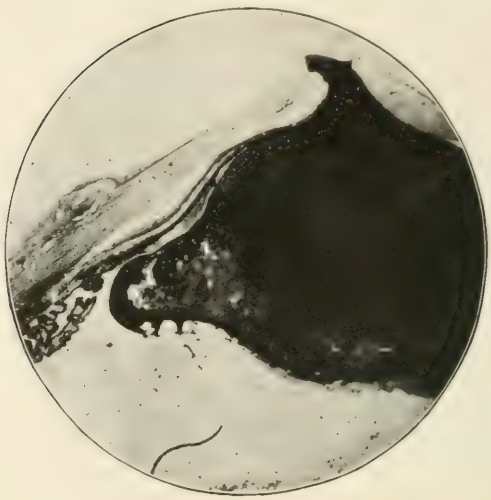

FIG. 14.—A perforated Wound of the Cornea with prolapse of Iris and Lens. Occlusion of Anterior Chamber and Filtration Angle.

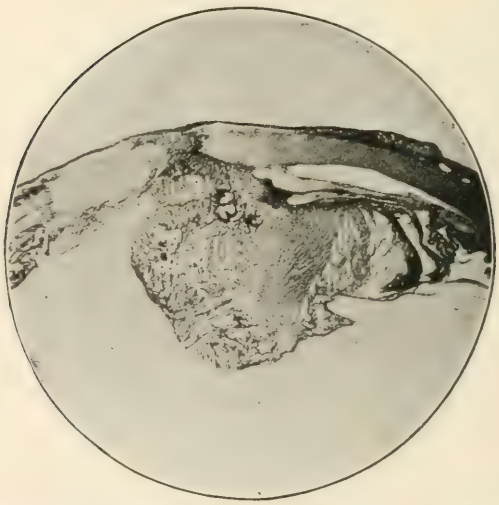

FIG. 15.—Perforating Wound of Cornea, prolapse of Cataractous Lens and Iris into Corneal Incision shutting of Anterior from Posterior Chamber.

FIG. 16.—Inclusion of Lens Capsule in Corneal Incision following Operation for removal of Senile Cataract.

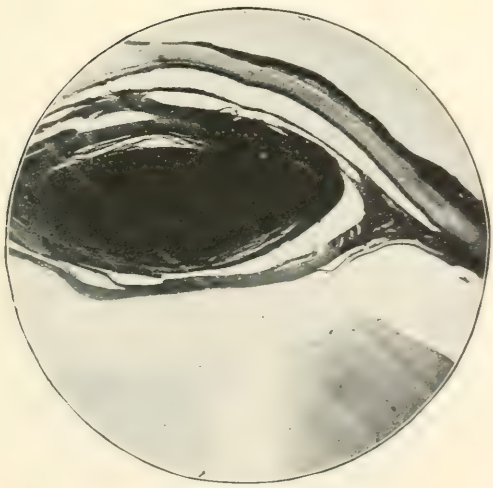

FIG. 17.—"T" or Umbrella shaped separation of Retina the result of a choroidal Sarcoma. Prolapse of Lens with Iris pressed into direct contact with Cornea. Complete obliteration of Anterior Chamber.

FIG. 18.—Complete Obliteration of Anterior Chamber from prolapse of Lens following complete separation of Retina in case of extensive Sarcoma of Choroid.

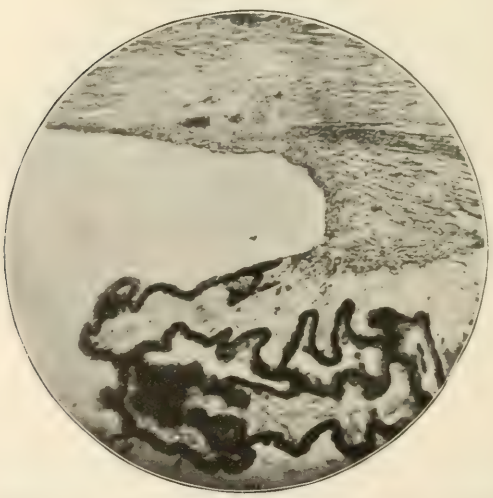

FIG. 19.—Iridectomy in Glaucoma, Filtration Angle successfully freed.

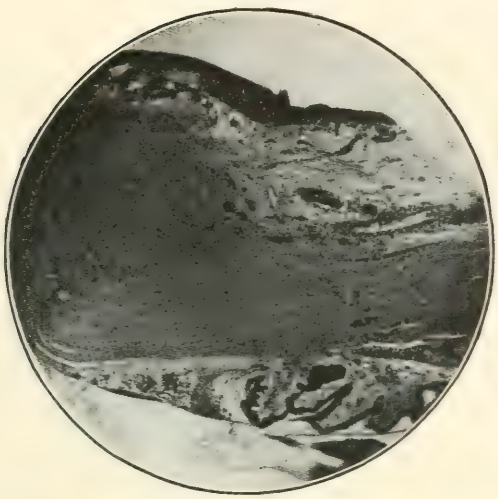

FIG. 20.—Unsuccessful Iridectomy for the relief of Glaucoma. Root of Iris has fallen forward on Cornea at Filtration Angle blocking Canal of Schlem.

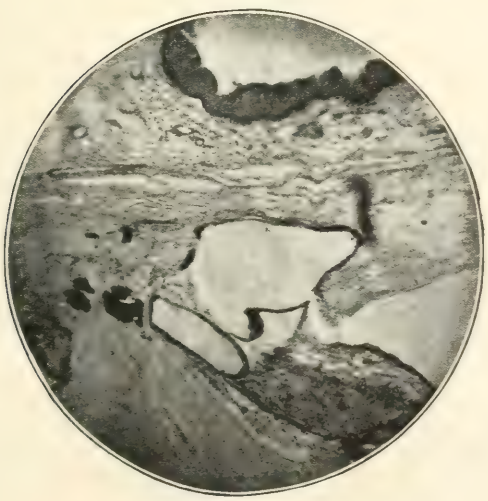

FIG. 21.—Iridectomy with partial Cystoid cicatrix at point of Incision in some features resembling procedures advocated by Lagrange, Elliott, and Herbert.

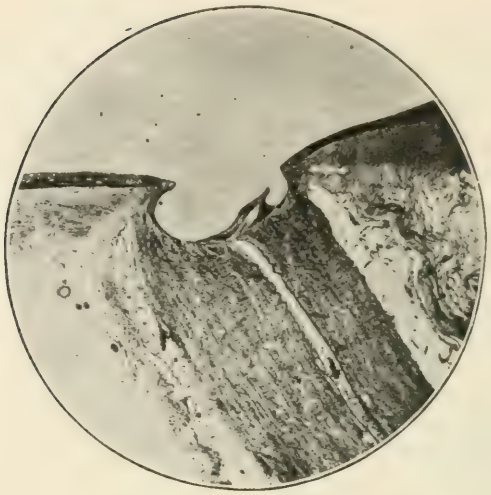

FIG. 22.—Longitudinal section of Optic Nerve. Section directly through Central Vessel at its bifurcation. Marked Cupping of Optic Nerve with compression of fibres about Lamina Cribrosa.

FIG. 23.—A case of marked Cupping of Optic Disc in Absolute Glaucoma; a large dilated vein noted as dipping over margin of disc.

VISION IN RELATION TO MARKSMANSHIP.

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U. S. Navy.

During the winter of 1911, by direction of the comander-in-chief of the U. S. Atlantic fleet, a number of gun pointers and trainers were sent from various battleships then at anchor in Guantanamo Bay, Cuba, to the hospital ship "Solace" for ocular examination. This with the view of determining the relation that visual acuity has to accurate shooting; also as to whether the pointers and trainers should be selected with more consideration as to vision than is now required, to the end that the maximum efficiency in gunnery may be attained in so far as the eye is concerned.

It will be remembered that for the past three years a visual acuity of 20/15 in the sighting eye and 20/20 in the other eye has been required by navy general order, before a man can qualify for the rating of either gun pointer or trainer. This means that with the eye to be used in sighting, the applicant must read the test letters at a distance of twenty feet, which the so-called normal eye must approach to within fifteen feet in order to read. This might seem paradoxical were it not for the fact that a vision of 20/20, which is generally accepted as normal, is in reality a very low standard. Many individuals have vision far in excess of this, in fact a vision of 20/15 would more justly represent normal vision.

Several years ago investigations were carried out which showed that 78% of all the gun pointers examined, and then in the service, had a vision of 20/15 or better in at least one eye. This was done prior to the time when any exceptional vision was required to enable the men to qualify for the rating, and shows that by natural selection over three quarters of the men had this good vision. Later it will be shown that a like degree of visual acuity entails a proportionately small amount of astigmatic error.

Before the present examination was commenced, test letters were constructed which exactly subtended, vertically and horizontally at the distance indicated, an angle of 5′ at the nodal point of the eye. The component parts of each letter subtended an angle of 1′. (Snellen's principle.) They were of the "unlearnable" pattern used in the navy which precludes the possibility of the examinee aiding his vision by previous memorization of the letters. These letters were of the gothic type as shown in Fig. 1. Many of the vision test charts in common use vary so much in the size of the letters supposed to be seen at the same distances, that the

tabulation of visual acuity will depend to a great degree upon the particular chart used. Unless a new set of letters is presented each time a man is called upon to read, he unconsciously remembers many of the letters and the value of the test is impaired to that extent. Both factors lead to confusion, and therefore the above precautions were taken to insure accuracy in our tests.

In addition, every man was examined by the "international" test, (Landolt's broken circles), Fig. 2. In a similar way the circles were carefully drawn to conform to Snellen's principle. A separate series for each foot in distance were made, thereby giving the results of visual acuity very accurately. It was found that the letters could be read almost exactly two feet farther away than the circles of the "international" test, subtending the same angle. That is to say, a man with 20/15 vision by the former test would have only 20/17 vision with the latter. Besides its universal adaptability, the "international test is unquestionably the more accurate as a test for vision but its disadvantages are many and important and it is very doubtful if it ever becomes of general use.

P H E
A O N
F N T
P Y A

Fig. 1.

Fig. 2.

Figures 1 and 2 have been so constructed as to correctly represent a vision of 20/8 and 20/10 by their respective methods, when properly viewed. If the reader will close one eye, and with the other eye observe these charts in good light at a distance of 20 feet, he will have an idea of the visual acuity possessed by the sighting eye of the best visioned gun pointers in the U. S. Atlantic Fleet. For at this distance a few will read every letter correctly, and also tell in which direction the openings in the circles point, in either case using one eye only.

Two hundred and seventy heavy gun pointers and trainers were subjected to examination. This included vision, refraction of each eye under a cycloplegic (Homatropin 2%, cocaine 2%), the range of accommodation before, during and after cycloplegia, effect of myotics, muscle tests at varying distances and ophthal-

moscopic examination in every case. Only the results of vision, refraction and ophthalmoscopic examinations will be considered in this article. The additional data obtained is to be used in connection with future investigations. All these men were in excellent health, living under excellent hygienic conditions. Their ages range from 17 to 37 years as indicated in the accompanying diagram, Figure 3.

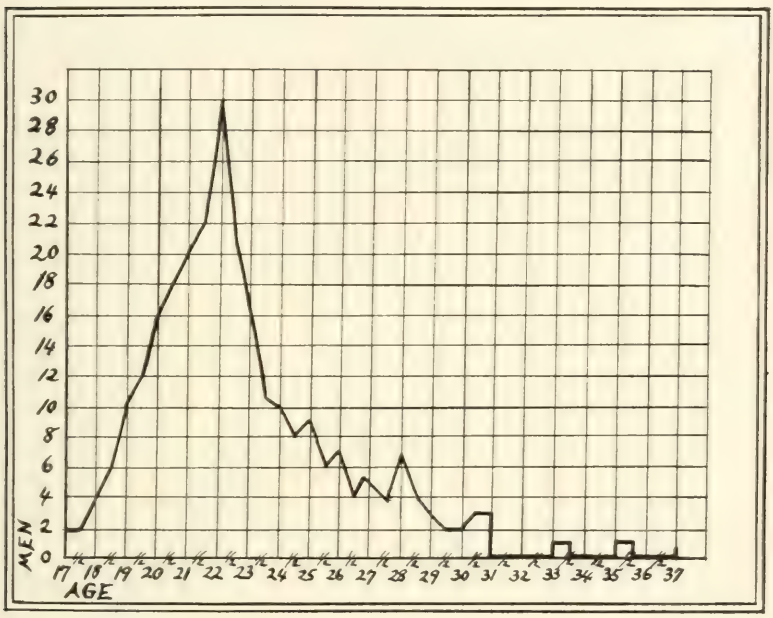


FIG. 3.

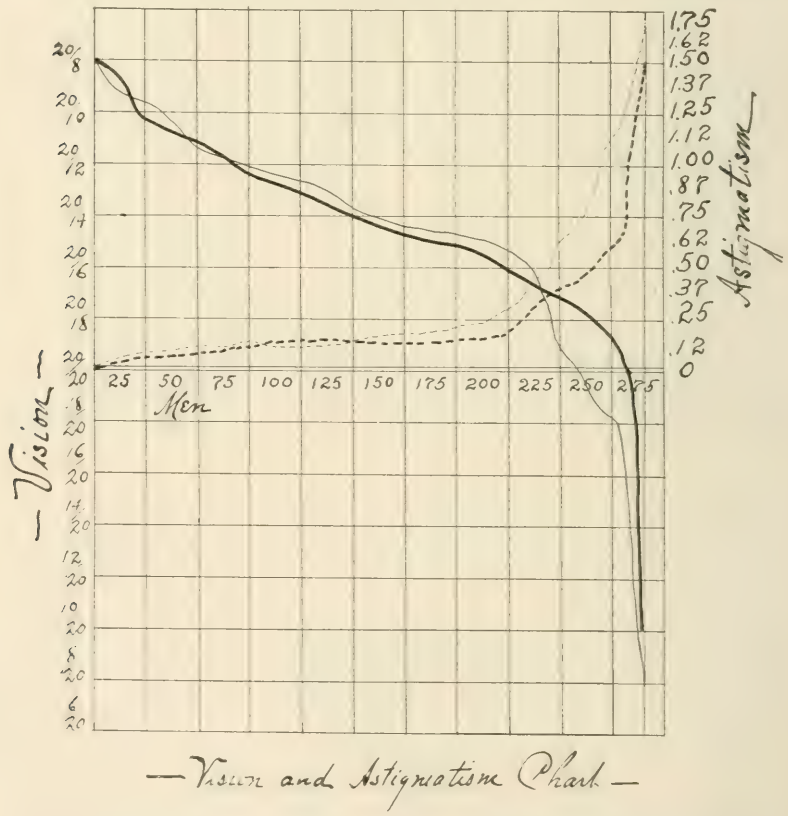
It will be noticed that the great majority of the pointers and trainers of the heavy guns in the U. S. Navy are comparatively young men.

The vision and manifest refraction were first taken, followed by the static refraction and a postcycloplegic refraction which was determined several days later. Care was taken to ascertain the full error, especially the astigmatism in each case.

The chart, Figure 4, graphically shows the vision and astigmatism present in each eye of all examined. The heavy continuous line representing the vision in the sighting eye (in 92% of cases the right eye), and the narrow continuous line the vision in the non-sighting eye. The heavy broken line represents the astigmatism in the sighting eye and the light broken line the same

condition in the other eye. The amount of astigmatism is indicated vertically at the right in diopters. The double base line represents the level of so called normal vision (20/20). The figures immediately below this line indicate the number of men examined, grouped in lots of twenty-five. The fractions at the left indicate the vision.

It will be noticed from the chart that a large majority of the gun pointers have more than 20/20 vision. This is accounted for in part by the visual requirements to qualify for the rating, and in part by natural selection. There are only a few men whose sighting eye is below 20/20, and most of these have a vision only a little below that standard. It will be seen that for the men with an acuity of vision above the average the amount of astigmatism



—Vision and Astigmatism Chart—

is extremely small, and as soon as vision falls the amount of astigmatism increases proportionately. The defect in vision could be accounted for in all these cases by the astigmatism, for when this was corrected by appropriate glasses the vision was brought up to

normal or better. The highest astigmatism noticed in the sighting eye was 1.50 diopters, whereas in the non-sighting eye 1.75 diopters was found in a single case. Nearly 200 of those examined had an astigmatism of .25 diopters or less. In not a single instance was over .50 of a diopter of astigmatism found in a man with more than 20/15 vision. Thus it would appear that comparative absence of astigmatism was a desirable quality, and so it proves to be.

Astigmatism is the effect produced by the unequal refractive power in two principal meridians of the eye which are generally at right angles to each other. This condition may allow of a clear image of objects, say in the vertical meridian; but at the same time a clear image in the horizontal meridian cannot be obtained, and only by a change in the accommodation of the eye can this horizontal meridian be corrected, at a sacrifice, in turn, of clearness in the vertical meridian, and so on. It is next to impossible for an observer to control his accommodation at will. so as to eliminate the defect in any meridian especially under conditions similar to those which our gun pointers have to meet.

The telescopic sights used on the large caliber guns in the U. S. Navy contain, in addition to a proper lens system, a glass on which are etched two lines crossing at right angles, one vertical and the other horizontal, by the aid of which the gun is effectively aimed. The arrangement is such that the gun pointer is chiefly concerned with the latter and the trainer with the former. If the telescope is properly adjusted and the observer's eye is sufficiently free from astigmatism he will see both of these lines distinctly at the same time and can clearly sight either line on the target as the occasion demands. Should considerable astigmatism exist it would be impossible for him to see both lines distinctly, at least one line would be more or less blurred, and if it happened to be the horizontal line that was indistinct the pointer would have trouble in accurately sighting his gun, or if the vertical line was in question, the trainer would experience a similar difficulty. Often the blurring of one of the cross lines will be so great that it will appear to be double. This happened in two cases to be mentioned later. The same may have happened with other men, but not admitted, as there is a temptation for both pointers and trainers to minimize their ocular defects, to enable them to retain their rating, which entails an increase of pay.

It is possible that the eye can compensate for astigmatism of slight amount (.37 D) by an unequal contraction of the ciliary muscle, only at the expense of eye strain and ocular fatigue, however.

Experimentation with the Mark (XI) telescope showed that an astigmatic error of over .75 of a diopter slightly blurred one or the other cross lines, depending upon which line the eye was in focus for at the moment. It would appear that any astigmatism under that amount had a negligible effect as far as pointers and trainers using telescopic sights were concerned.

Consulting the records, it is found that there were but two men with less than .75 of a diopter of astigmatism, but who have not at least 18/20 vision or better, and in one of these cases the defect was the result of a previous corneal ulcer, and of the men who had an astigmatic error of more than .75 of a diopter nearly all had a visual acuity of less than 18/20.

The practical point to be gained here is that dangerous amounts of astigmatism can be easily eliminated by the medical officer by simply passing upon the visual qualifications of the candidate to be examined. The visual requirements which until recently have been supposed to have been observed, viz., 20/15 vision in the sighting eye and 20/20 vision in the other eye, would farther remove the possibility of dangerous amounts of astigmatism.

The records show that 20/15 vision practically eliminates the chance of any one having .50 of a diopter of astigmatism, which is a perfectly safe amount for purposes here considered.

There is no evidence to show that a higher vision than this is of any particular value when telescopic sights are used.

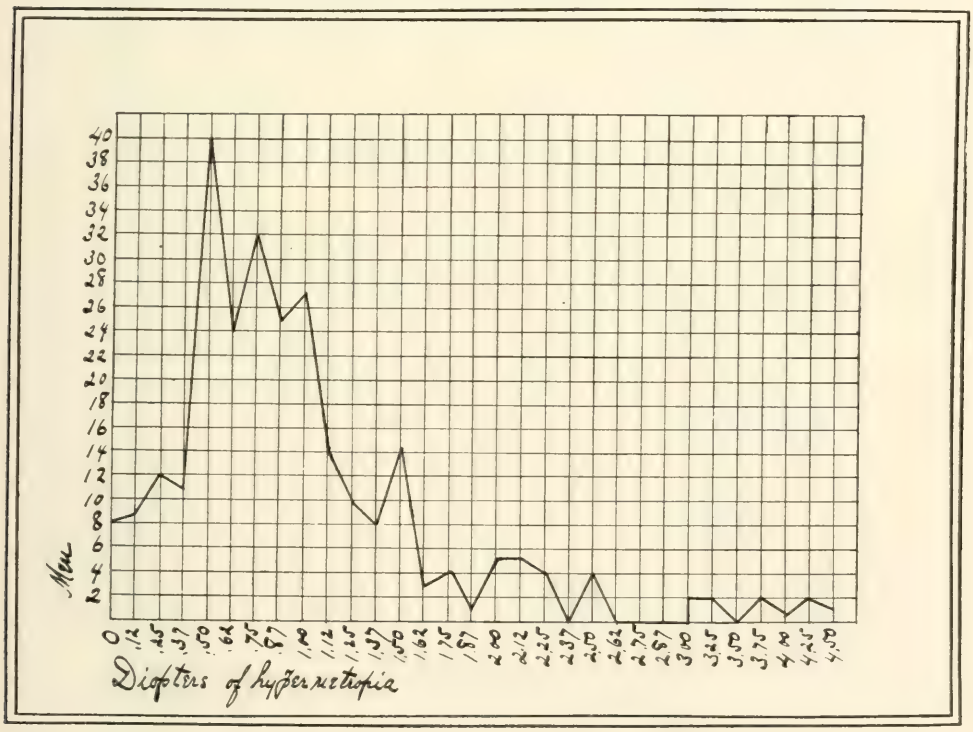
A reduction of visual acuity from 20/15 to 18/20 as determined by our method of examination by test charts, gives the reader an impression of far greater proportionate loss of real seeing power than actually exists. Two individuals, one having the former and the other the latter vision, will be found to have a nearly equal perception of general objects in outdoor life, and when telescopic sights, of such power as are attached to the guns in the U. S. Navy, are used the difference is so slight as to be hardly appreciable. Experimentation with the Mark XI telescope has established this fact, which is well to remember in connection with the recommendations that follow.

Myopia was not found in a single instance among those examined. In one case, however, a myopic astigmatism of —.25 cyl., ax. 180 wes present in each eye.

Certainly a myope could hardly be expected to do well on an ordinary rifle range unless he wore glasses correcting the defect, in which case he would experience no difficulty in marksmanship as far as eyesight was concerned, provided his vision was sufficient

after correction. On board ship it is impracticable for the pointers and trainers to wear correcting glasses. Therefore a near-sighted person would have no place at the telescopic sights of the heavy guns in the Navy, as the instruments are rigidly set at a certain fixed focus prior to going into action, by some one in authority, and could not be frequently changed to suit the convenience of near-sighted men who might be suddenly called upon to use them. With us the entire subject of myopia can be easily eliminated by observing definite visual requirements. With hyperopia it is entirely different. Here a man can have little or much of this error of refraction and still may satisfy our vision tests, as previously conducted.

Among those examined the static hyperopia varied from .12 of a diopter to 4.50 diopters. The majority were found to have from .37 of a diopter to 1.00 diopter. See Chart No. 5.



A gun pointer with 4.50 diopters of hyperopia must accommodate that much in order to see clearly at a distance. The same would be true if he were to sight through a telescope with a focus fixed for an emmetropic eye. Should he be unable to hold this

amount constantly, or through sudden fright or excitement should his accomomdation suddenly relax and pass from his control, he could not see a ship at 10,000 yards, and therefore would be deprived of proper command of his telescopic sight.

In action, likewise in practice, it would be unwise to trust the effectiveness of an entire gun's crew to a pointer or trainer with such a defect. Fortunately there was only one man found with this amount of hyperopic error, though there were several who had only slightly less. The older the man, and generally the more experienced and valuable to the service as a gun pointer, the more serious would this defect become and the more difficult to control.

There were four men from the entire number examined who complained that after sighting with the telescope for a time their eyes became tired and that they could not see well. "Everything blurred," as they expressed it, until they had rested their eyes or rubbed them hard, after which they could continue for a while, when the same process had to be repeated. Examination showed that three of them had a hyperopia of 4.00 diopters and over, and it is quite probable that fatigue had made it impossible for them to continuously hold that much accommodation, and it had relaxed, causing the blurred vision.

From whatever cause such men would be at a disadvantage, for in any modern naval engagement that is likely to take place there would be little opportunity given gun pointers to rest their eyes without seriously interfering with the efficiency of the gun. Exactly what amount of hyperopia would represent the maximum of safety has not been entirely satisfactorily determined, but it would not be safe to accept men with over 3.00 diopters.

Occasionally a condition of spasm of accommodation exists, due to long continued eye strain, excitement, fear, etc. This will occur most readily in men who have important errors of refraction which particularly tend to fatigue the eye, rarely in normal eyes. Fortunately this sudden spasm is not frequently found among gun pointers as far as can be determined, for those who are subject to this peculiar trouble are for the most part eliminated early in the competitive trying-out process. When it does occur the individual is utterly unable to use his telescopic sight until the condition passes off, a variable length of time. Neither a gun pointer nor trainer who is subject to this peculiarity should be kept in the rating. To reduce the possibility of such men remaining, officers in charge of guns' crews should observe the signs of sudden blurred vision among the men under their command and inquire into all

complaints of inability to see clearly, especially arising among those who gave every evidence of good vision at previous exercises. Such cases should have a careful ocular examination to assist in determining their future fitness.

A subject of importance is the parallax between the object aimed at and the cross lines in the telescope. If the instrument is accurately constructed and the cross lines are exactly on a plane at right angles to the columination of the lenses, then the parallax can be eliminated by careful hand adjustment before it is put into use. This is always attempted and with patience the telescopic parallax can be reduced to a negligible amount, provided a person whose eye is free from marked astigmatism or other serious ocular defect will do the adjusting.

Experiment shows that if a considerable amount of astigmatism is introduced before the observer's eye an ocular parallax is created which is not correctible by any adjustment of the telescope itself. In persons with high astigmatism it is found that the parallax in both cross lines cannot be eliminated. A slight amount of parallax makes a marked difference in the alignment of an object several miles away and reduces the accuracy of gun fire to that extent. Great pains have been taken to free the telescope from this defect, but heretofore the eye has evidently not been considered as a source of parallactic disturbance. It is found that an astigmatism of considerably over .75 of a diopter is necessary to introduce a detectable amount of ocular parallax. Fortunately danger on this score can be easily avoided by simply exacting a vision of 20/15 in the sighting eye of all applicants desirous of qualifying for the ratings of gun pointer and trainer. This would insure freedom from amounts of astigmatism sufficient to cause this trouble at the beginning of the individual's career. Plenty of men can be obtained with such vision or better. It must be borne in mind that most of the telescopic sights are made so that they can be set in focus for all objects beyond 1,600 yards, for normal eyes, the adjustment for parallax alone remaining. These changes are generally made by some one of experience. The telescope is then fixed in position and the gun pointer and trainer must do his sighting through the instrument as he finds it. A moment's reflection will convince one that such an arrangement is a necessity, as frequent and individual readjustments of the telescope during action would be impracticable. This being the case, the greatest care should be taken that the initial adjustment is accurate.

Several complaints were made by men who did not make par-

ticularly good scores to the effect that their telescopes were not accurately set in focus by the person having that duty to perform. Whether this reason was real or imaginary, the writer cannot say. Such an accident is not beyond the realm of possibility, especially if the adjusting was made by one who had a considerable amount of uncorrected refractive error. As several men in succession may have to use the telescope as it is set, it would seem that the only way to eliminate a reasonable possibility of such an accident occurring would be to be certain that all who adjust or who would be likely to use telescopic sights were free from dangerous amounts of refractive error.

As an aid in determining the relation that eyesight bears to shooting, the individual scores of marksmanship during the fleet record target practice for 1910, as well as the small arms (rifle) record of those who fired was obtained. Comparisons among heavy gun pointers and trainers are difficult and somewhat unsatisfactory, due to the fact that many alternating factors enter into the final credited score, such as penalties, errors in spotting the individual shots, lack of experience, difference in caliber of guns used, poor trainers lowering the scores of ordinarily excellent pointers, and vice versa. Nevertheless, certain general results have been obtained which are instructive. Pointers of 8, 10 and 12 inch guns alone are considered in the following tabulations:

In the first place the scores of twenty men whose vision was in each case 20/10 or better in the sighting eye were compared with the scores of an equal number whose vision was below 20/20 (16/20 average). This comprised all the men available who fell into these two groups, and represents the extremes of vision among the entire number examined. It was found that the former averaged 4.18 hits out of five shots (83.6%), while the latter averaged only 4.15 hits out of 5.23 shots (79.7%), a record slightly in favor of those with the maximum vision. When considering the rapidity of shots and hits, which is a most important feature, it was found that the group with highest visual acuity made on an average of 1.370 *hits* per gun per minute with 1.819 *shots* per gun per minute, while the group with the least visual acuity made 1.616 *hits* per gun per minute with 2.215 *shots* per gun per minute; a result only slightly in favor of those with the better vision. A few men who would not have been allowed in the rating if proper visual requirements had been observed, lowered the average of those having the less vision very materially.

For purposes of an additional comparison, the entire number of

men examined was divided into two groups, one in which the vision in the sighting eye was 20/15 or better and the other in which the vision in the sighting eye was less than 20/15 (10/20 a minimum). Having due regard to the caliber of the guns fired, it was found that the former made an average of 81% of hits against 78.9% of hits for the latter. When the time factor was considered it appears that the average for those with the better vision was 1.688 *hits* per gun per minute out of 2.011 *shots* per gun per minute, whereas the average for those with the poorer vision was 1.691 *hits* per gun per minute out of 2.099 *shots* per gun per minute; a record but very slightly in favor of those with the better vision.

The number of shots fired in a given time depends almost entirely on the ability and training of the gun's crew, the trainer and pointer being relied upon for the hits out of the shots afforded. The difference is so slight in the two groups mentioned that it is reasonable to suppose that the question of vision, at best, plays a negligible part toward the efficiency of marksmanship among gun pointers and trainers using telescopic sights, provided the vision does not fall below a certain level; and provided further, that the astigmatism is not of such amount as to introduce ocular parallax or blur one of the cross lines in the telescope.

One man who, acting as trainer for two 12 inch guns, with 17/20 vision in the sighting eye and only .37 of a diopter of astigmatism, made 12 hits out of 12 shots with both guns, an excellent record; whereas the next man examined, acting as pointer of an 8 inch gun, with the same vision, made only 2 hits out of 6 shots; but it was found that he had 1.25 diopters of astigmatism and had complained of eye strain whenever he tried to sight with the telescope.

It has been frequently noticed that those men with large amounts of astigmatism do not shoot particularly well, but not always has it been found to be the case, though only rarely has the reverse been true. The above case is a marked example among several discovered.

There is evidence to show that in some cases the longer the man is engaged as pointer or trainer the poorer his vision becomes. Several men have complained of this, saying that they realize that they have not as good eyesight as they had before they were constantly kept at practice. To exactly what degree this is true, it is impossible to state from the present data, but it is not unlikely that there is a tendency for the vision to be lowered somewhat as the man becomes older and the additional strain of pointing or

training is experienced. This is emphasized by the fact that most of those who have had several years of gunnery experience to their credit, and who are recorded as among the best shots in the fleet, not infrequently are found to have a visual acuity below the former requirements. To reject such men for slightly defective eyesight, provided it was not due to progressive organic disease, would seem to be absolutely unwarranted if the best interests of the service are to be considered. It is a long, tedious and expensive process to train these men, and when so trained they are of such great value that reasonable concessions should be made in respect to their visual requirements, especially when evidence shows that a slight deterioration in sight, very little, if any, impairs their efficiency nuder the conditions in which they are called upon to act. The time to consider vision is when the applicant first presents himself for the rating of gun pointer or trainer. A sufficiently high vision requirement then will obviate most of the troubles that are likely to occur later. While nothing is to be gained by requiring more than 20/15 vsiion, that much, however, *is* advisable in order to eliminate in an easy and practicable way the defects previously mentioned. Later if the vision falls below 18/20, a careful ocular examination should be made by some one qualified in that line of work, in order to exclude beginning organic disease, effects of injuries, etc., and the case then decided on its merits.

Examination of all gun pointers and trainers should be made at least once a year by the medical officer of the ship to determine this point. If the original requirement of 20/15 is exacted very few cases will ever come up for special examination, which is a very practical point.

Some interesting individual conditions were discovered among those examined, a few of which are given below:

1. A 12 inch gun pointer (E. C. S.) had a well-marked scar near the center of the right cornea, the result of a previous ulcer. It looked as if the opacity would prevent his having anything like good vision, but it was found on examination that he had a large angle "gamma" and that his line of vision passed slightly to the nasal side of the opacity, giving him a visual acuity of 20/18 (static refraction, R. E. +.50 +.50, ax 90). He suffered from anisometropia. The left eye was considerably hyperopic (+4.25 D) and from lack of accommodation could not use that eye in sighting with the telescope. He relied entirely on his injured right eye for sighting. He made 4 hits out of 4 shots with the 12 inch gun in 1 minute and 56 seconds, which was one of the best records in the

entire fleet. It should not be inferred that such a case would be proper selection for a gun pointer, but rather an exception which gave good results in face of ocular defects which should be classed as prohibitive.

2. (H. C. B.) Trainer of a 12 inch gun, vision 20/15 each eye, complained that his eyes would "water" when using them at the telescope, and that his sight would blur after looking steadily for any length of time, also that he liked to frequently rest his eyes when at the sighting hood. Such a man might be compelled to take a rest at a most inopportune time in actual warfare, and, as a trainer of both 12 inch guns, would reduce the efficiency of an entire turret. Examination of his eyes showed that his accomodation was very active, the slightest irritation produced abundant lacrimation and the eyes were hyper-sensitive. There was very little error of refraction. It would be inadvisable to continue such a man in this rating, even though his work was given as "satisfactory." Similar cases would pass our preliminary visual requirements, hence the need of constant observation of these men after they have entered upon their duties.

3. (H. F. H.) Pointer of an 8 inch gun, vision R. E. 17/20, L. E. 15/20, fired two years to qualify as a pointer and failed. States he has had more or less trouble with his eyes and for some time that he worked with searchlights considerably and believes that his eyes have been injured thereby, as he cannot see to read well. He was apparently suffering from retinal asthenopia. In two record practices he made only 1 hit out of 4 shots in each practice. (Records show that he was given the wrong range in the last practice, which was not his fault.) Has very little astigmatism and it is quite likely that the searchlight has had a deleterious effect on his eyes. Instances have been known where the ocular structures have been affected by working in close proximity to the powerful radiations from these lights. Such cases should be rejected. The diminished vision alone would at original rating have been a bar if requirements had been observed.

4. (A. P. C.) Trainer, 12 inch gun, vision R. E. 15/20, L. E. 20/15, states that he is obliged to sight with the left eye when either using the telescope or shooting with the service rifle. With the former it is of no special inconvenience to use the left eye, but it is very awkward to sight the service rifle with that eye, and especially as he is right-handed. He is a poor shot with the rifle, and has 1.00 diopter of astigmatism, ax 105, in the right eye and almost none in the left. This accounts for his diminished vision

in the right eye. He finds that in spite of the awkwardness he does better by using the eye with the least astigmatism. This case is characteristic of several others, indicating that astigmatism of more than small amounts is a frequent cause of ocular inefficiency in shooting.

5. (P. F. S.) Pointer, 8 inch gun, vision R. E. 20/18, L. E. 20/11, states that he sights with his left eye when using the telescopic sight, simply because he sees more distinctly. Is very nervous and states that he never was able to hold the service rifle steady. He is about the poorest rifle shot among all those examined, yet in pointing the 8 inch gun his work was satisfactory. There is a marked difference in the character of the duty between pointing an 8-inch gun and sighting with the service rifle. Several men did well with the former but not the latter. The temperamental qualifications are not a part of this discussion, but they are very important and can only be properly weighed by a thorough trying out process at the gun.

6. (G. W.) Pointer, 8 inch gun, vision R. E. 20/16, L. E. 20/15, states that his eyes grow tired easily and feel weak when he is kept waiting at the sighting hood of the telescope for any length of time, and that the condition of his eyes bothers him so that at times he does not care whether he hits the target or not. This man's static refraction was OD+.75+.25, ax 20; OS+.75 +12, ax 20. While it is not intended to deal with the conditions of the extra ocular muscles as a factor in shooting, in this paper, yet this case is so suggestive of other similar conditions that it is thought wise to mention it. This man had an exophoria of 5$^{\Delta}$ at 20 feet, 14$^{\Delta}$ at 15 inches, and a right hyperphoria at 2$^{\Delta}$. There are very few eyes that would not rebel with a double muscular imbalance of this nature, and it is not surprising that he should have had trouble. Such a man would not be a good selection for a gun pointer, yet he would readily pass our present physical requirements. Men who shoot use but one eye in sighting; the other is closed or the image is disassociated, hence a muscular imbalance is in a measure relieved during the act of aiming; but as soon as binocular vision is resumed the ocular strain and fatigue returns, all of which tends to deprive the man of that ocular equilibrium which is conducive to the best effort.

7. (F. A. G.) Pointer, 8 inch gun, vision R. E. 16/20, L. E. 15/20, static refraction R. E. +.50+1.25, ax 180, L. E. +.50 +1.50, ax 180. This man stated that he could not see very well when using the telescopic sight. The horizontal cross line ap-

peared double, whereas the vertical line was nearly always single. This is of importance, as it is the gun pointer's duty to keep the horizontal line on the object to be fired at, continuously, and if the line seems double he cannot effect a satisfactory aim. A slight error here means much when the object is miles away. The defect can be most easily avoided by requiring sufficient vision to eliminate astigmatism of any such amount as could cause this condition. Another case occurred similar to the aobve which further emphasizes the fact that astigmatism of considerable amount should be a cause for rejection for those engaged in telescopic pointing and training of the guns in the U. S. Navy.

8. (D. McK.) Trainer, 12 inch gun, vision R. E. 17/20, L. E. 16/20, 38 years of age, static refraction R. E. +1.50+.37, ax 100; L. E. +1.50+.50, ax 80. Although this man has a visual acuity below the requirements for his rating, yet with the two 12 inch guns which he trained he made 12 hits out of 12 shots in 2 minutes and 58 seconds (previously cited), and in the record practice the year previous he practically equaled the score. But this man has had eleven years of constant practice in this line of work and has become highly proficient. This case is illustrative of several, showing that with comparatively poor vision according to a gun pointer's standard, most excellent shooting is yet possible, especially when supplemented with years of experience, and telescopic sights are used. It should be noticed that he had only a moderate amount of astigmatism, however. It would be unwise not to retain men who fall within this class, and some provision should be made by regulation to allow them to continue in their rating as long as they make excellent records, even if the vision has fallen some during their years of practice. To what extent it is safe to permit the vision to fall, without question, is a difficult problem. From evidence gathered from all examined it would seem that it would be perfectly safe to accept a reduction to 18/20 in the sighting eye among those who had previously satisfied the maximum requirements; and to a minimum of 15/20 in the other eye, provided no organic disease or other defect prohibitive of good shooting existed, as determined by some one qualified in this line of work. In other words, a vision falling below 18/20 should call for a thorough ocular examination. It would be a doubtful experiment to permit men to continue in such important positions as gun pointers and trainers after the vision had fallen below the amounts stated, except in the msot exceptional cases, and then only after a careful examination of the eyes had been made.

Another man complained that he did not wish to be a gun pointer because he did not like the duty and took no interest in the work whatever. His heart was set on being a laundryman, where the recompense was greater. Although it was found out that he had previously done satisfactory work as a pointer, yet it is questionable whether such a man should be retained in the rating unless his very best energies will be devoted to the work.

Not a single case out of the entire 270 was found to be suffering from any fundus trouble, indicative of a pathological condition. Curiously enough, however, there were seven men who presented well-marked Gunn's dots around the macular region (described first by the late Dr. Marcus Gunn, and sometimes spoken of as Crick's dots, from the name of the patient in whom they were first exhibited). Although they made a striking appearance when seen in abundance, yet no defect in vision can be attributed to them; the average vision being 20/13 and the lowest 20/20 among those who presented the condition. They were found in both eyes in every case. No pathological significance can be attributed to them, beyond possibly the result of eye strain, and they are mentioned only because they might be taken as an indication of serious retinal or choroidal disease by those not accustomed to their appearance. The same condition has been noticed frequently among the midshipmen at the Naval Academy, and should not be a cause for physical rejection.

It is often heard that men with dark irides do not make as good shots as those of lighter hue. Careful observance was made of this point, and it is very doubtful if this theory has any basis in fact. It is true that 72% of the pointers and trainers examined had light eyes, but that is nearly the proportion found among the average crew, consequently there is a larger percentage of men of that type from whom to select. As to the relative shooting ability of these two classes of men no difference was discovered worthy of record.

In addition to heavy gun shooting, some attention has been given to firing with the service rifle. Individual scores were obtained from nearly all of the 270 men previously considered, who fired, on the range on shore, at the varying distances of 200, 300 and 500 yards. The average scores of those who had better than 20/15 vision were compared with those having less than 20/15 (10/20 as a minimum), and it was found that the men with the better vision averaged rather the better score in proportion of 108 to 99, 150 points being the maximum.

As these figures were computed from a large number of men, shooting at different times, many features other than vision would enter to influence the records, and the slight advantage above given to the credit of those with the better vision should not be taken as the standard of relative advantage that this class of men experience.

When shooting at a large, white target, the kind generally supplied at rifle ranges, any vision that will permit the marksmen to see the target with some distinctness will permit of his making a good score, especially so if he is aided by judgment and experience. Consequently, men with only 10/20 vision will often do as well as those who possess the best eyesight. Frequently men have stated that they were unable to see the bull's-eye, but realizing that it was in the center of the large white target, which could be seen, they were able to make excellent scores. This has often been proved to be true. Shooting on a range or in a gallery is far different from shooting in actual warfare. Under the latter conditions, a man to make a good individual shot, must at least be able to first discern the object before he can expect to aim; and the object may be small, indistinct and far away so that good eyesight is necessary to see it; while under the former condition the target is so large and plain that the average man has little trouble in seeing it even if his vision is very poor. Both may do equally well on the range but the man with the better vision will have a material advantage when called upon to pick out and shoot at an object under favorable conditions as would often happen in actual service.

The exact relationship that vision bears to rifle shooting has never been satisfactorily determined. Many statistics are given by writers on this subject to show that men with comparatively poor vision will make just as good scores as those with exceptional vision, and that it is a waste of material to reject those men simply because their vision is below normal. These statistics are based on range or gallery firing and are therefore of no value in determining the real relation of eyesight to marksmanship. Contrary to the often expressed opinion, the writer believes that exceptional vision is of some advantage even on rifle ranges and in galleries.

The members of the U. S. Marine Corps Rifle Team for 1911 were refracted and had their vision taken prior to entering upon their preliminary practice at Wakefield, Mass. It was found that all except one man had less than .37 of adiopter of astigmatism, and he had exactly that amount. Their vision averaged 20/14 in the sighting eye. These men were selected from a large number of try outs, not from visual tests, but from their ability to shoot

well, and it is interesting to note what a small amount of astigmatism was found, as well as the fact that this team won the National Trophy Match for 1911, against 42 competing rifle teams at Camp Perry, Ohio. These men wore a specially constructed shooting glass (Hallauer No. 64), which also included their astigmatic correction and brought their vision up to 20/10 or more in each case. To obtain the best results even the little astigmatism which they had was corrected.

It is well recognized that other qualities than vision are necessary to make a man a good shot; at the same time it would seem in this case that the expert shots with the rifle were obtained from those men who had most excellent vision, accompanied with a minimum of astigmatism. Whether they would have done equally well with the vision at 20/20 or lower is problematical. However that may be, the members of the Marine Corps Team above mentioned, were given the advantage of exceptional vision and did most creditable work.

The accurate correction of the astigmatism not only aids in clearing up the definition but relieves a certain strain on the eye, which is of importance to those whose eyes are naturally under a severe strain, incident to long and continued sighting, and especially to those who are suffering from other errors of refraction as well.

Conclusions.

Among the gun pointers and trainers of the U. S. Atlantic Fleet, who were examined, a reduction of visual acuity was almost invariably commensurate with, and due to, the astigmatism present.

Astigmatism of more than .75 of a diopter blurs and often doubles one of the cross lines in the telescopic sight and thereby interferes with accurate aiming.

Astigmatism of less amount may be considered as having a negligible effect for purposes here considered.

High degrees of astigmatism introduce an ocular parallax which cannot be eliminated even though the telescopic parallax is completely removed.

A visual acuity of 20/15 will, in a simple and practical way, eliminate all cases of astigmatism and myopia which by any chance would reduce or interfere with the most accurate aim which is possible to be obtained through telescopic sights. Plenty of men can be obtained who have this vision. Nothing is to be gained by a higher visual requirement.

The elimination of dangerous amounts of hyperopia cannot be accomplished by our simple visual tests. When this condition is

suspected a special ocular examination should be required to determine the amount. Hyperopia of over 3.00 diopters should be cause for rejection.

Exceptional vision is no guarantee of good shooting and ordinary or slightly reduced vision (18/20) if associated with less than .75 of a diopter of astigmatism, is no hindrance when U. S. Navy telescopic sights are used.

Twenty-nine per cent of the gun pointers and trainers examined failed to meet the visual requirements which have been in force since July 1, 1908. Many of these men have had several years' experience in gun practice and made most excellent scores. A slight diminution of vision often following long continued practice with telescopic sights. Such men should be allowed a moderate reduction in visual acuity so that they will not be disqualified for an ocular defect when it is of such amount as to be of no determinable importance.

The services of highly trained gun pointers, who by virtue of their experience are of incalculable value, will in this way be saved to the Navy.

Care should be taken that the individual who adjusts and fixes the telescopes in focus is free from any error of refraction which would preclude the possibility of others, who may be called upon in succession to use the same sight, from obtaining an accurate aim.

It is impracticable for gun pointers to wear glasses correcting their visual error and equally so for each individual to change the telescopic sight to suit himself. Consequently, it is imperative that the eyes of all who are to use these sights should be sufficiently near normal so that the gun pointers can instantly use any telescope as they find it, with a maximum of aiming efficiency.

In reference to small arm (rifle) shooting, an entirely different problem is presented. Any attempt to draw satisfactory conclusions as to the relation of eyesight to marksmanship is valueless, when an ordinary service target, such as is generally used, is the object. Men of experience in rifle shooting, with markedly reduced vision, will generally make excellent scores even though the bull's-eye is invisible, provided their vision is still sufficient to allow them to just discern the target, which is large, white and made as distinct as possible.

There is an intensely practical side to this important subject of the relation of vision to marksmanship which must be carefully considered. In view of all the evidence obtainable it is believed

that the best interests of the service will be furthered, as far as eyesight can possibly be concerned in relation to shooting with *telescopic sights,* by adopting the following requirements:

1. That all candidates for the ORIGINAL rating of gun pointer or trainer should have a minimum visual acuity of 20/15 in the sighting eye and 20/20 in the other eye.

2. Hyperopia of over 3.00 diopters is cause for rejection.

3. The medical officer of each ship should carefully re-examine the eyes of all men holding these ratings, at the beginning of each calendar year, entering the vision in the Health Record (Abstract) for future information. If the vision has fallen materially since the last examination or evidence of asthenopia or disease exists, an ocular examination should be made by some one trained in ophthalmology who will enter his findings and recommendations in the Health Record. Should the individual's condition be such as to warrant the revoking of his rating, full information of the case including recommendations, should be forwarded by the medical officer, through official channels, to the Department for consideration and final disposition. Very few will fall into this class if the original visual requirements are rigidly enforced.

4. Gun pointers and trainers who have served as such during one enlistment may on subsequent enlistments be accepted with a minimum visual acuity of 18/20 in the sighting eye and 15/20 in the other eye, provided such reduced vision is not due to propressive organic disease, myopia or astigmatism of over .75 of a diopter. Entry is to be made in the Health Record to such effect.

5. In all cases vision should be tested by the so-called Navy "Unlearnable Vision Test Card," as there is considerable temptation to learn the letters found on ordinary charts by those especially anxious to secure or retain the rating of gun pointer or trainer.

A COURSE IN OPHTHALMOLOGY AT THE UNIVERSITY OF COLORADO.

THE DEGREE OF DOCTOR OF OPHTHALMOLOGY.

It is gratifying to observe that whilst every effort is being made to advance the standard of medical education in this country, a movement is also on foot to establish courses of study which shall be worthy of the science and art of Ophthalmology.

Every medical college has nominally a department for diseases of the eye, and in some of the post-graduate schools the specialty receives good attention. But for a long, time the necessity has been felt for such a course of teaching as is requisite for the thorough training of good ophthalmologists who will, upon graduation, be worthy to receive a degree such as that of Doctor of Ophthalmology.

A few years ago a course in Ophthalmology was begun in connection with the Oxford University in England, which has the power to confer the degree of Doctor of Ophthalmolgy upon its graduates.

The University of Liverpool is giving a similar course.

In this country, some time ago, a few of the teachers in the Medical Department of Northwest University made an effort to meet the growing demands for thoroughly trained ophthalmologists, but the attempt was abandoned in consequence of lack of support on the part of the faculty.

It is, therefore, with great pleasure that we refer to the course in Ophthalmology which has recently been started in connection with the University of Colorado. This course embraces one year of post graduate work in Ophthalmology, including daily service in the eye clinic; a sufficient course of reading; attendance on demonstrations, lectures, quizzes and conferences on the refraction of the eye and its anomalies; the pathology, diagnosis and treatment of diseases of the eye; ocular injuries and operations.

The whole course may be taken at Denver. Six weeks' residence at Denver is required, but the clinical work may be done in any ophthalmic hospital or clinic having proper facilities for the study of Ophthalmology with the requisite clinical service. The summer residence work of the present year, 1912, included six or seven hours daily for six weeks, from June 24th to August 2nd, in demonstrations, clinics, laboratory work, conferences and lectures.

The last two weeks of the residence course, July 22nd to August 2nd, contained many special lectures and demonstrations

of great interest to those who have been engaged in Ophthalmic practice. Among these Dr. Edward Jackson (of Denver) gave a lecture on Accurate Skiascopy and Transplantation of Ocular Muscles.

Dr. Frank S. Todd (Minneapolis) on the Substitutes for Enucleation; and on Malingering or Pretended Blindness.

Dr. Casey A. Wood (Chicago) on the Operative Treatment of Trachoma.

Dr. W. C. Bane on Sketching Ocular Lesions.

Dr. Melville Black on Injuries to the Eye.

Dr. John Chase on Detachment of the Retina.

Dr. D. H. Coover on New Aids in Ophthalmic Diagnosis, and on August 1st, Dr. L. Webster Fox, of Philadelphia, delivered a lecture on newer Operations for Glaucoma with an exhibition of instruments and diagrams representing the stages of the Fergus-Elliot operation.

Our readers may be interested to know that the matriculation fee for all who have not previously matriculated in the University of Colorado School of Medicine, or the Denver and Gross College of Medicine

is	$10.00
Instruction	30.00
Examination and diploma	10.00
Short Course	15.00

Students who are graduates of at least one year's standing from a recognized medical school, who show evidence of the necessary study of algebra, geometry, plane trigonometry, and physical optics, and who have taken the full course, including the six weeks' residence work, will be eligible to a general examination on scientific and practical Ophthalmology. Those successfully passing the examination, and presenting a creditable thesis within six months thereafter, and defending the same, will be eligible for the degree of Doctor of Ophthalmology from the University of Colorado.

Denver is a city of 213,000 inhabitants and has five large general hospitals, aggregating more than 1,000 beds. The eye clinic of the University of Colorado has an average attendance of 30 patients a day and the service is supplemented by opportunities to see patients in the principal hospitals and in the private practices of members of the faculty and others.

The hope has been expressed that by extending such ophthalmological instruction and facilities in all the various medical schools, the "refraction specialists" or "ophthalmic optrometrists"

would find their work reverting to men thoroughly qualified in the treatment of eye diseases. But whilst this is a result greatly to be desired, it is of far greater importance that members of the medical profession should be given the opportunity to become thoroughly acquainted with ophthalmic practice in all its branches. By degrees Ophthalmology has come to be recognized as a department of medicine requiring special study and opportunities for clinical investigation. A glance at the bibliography of ophthalmic science is almost sufficient to appall one. The vastness and variety of the literature which has been produced in connection with the anatomy, physiology, pathology and treatment of diseases of the eye indicates the importance of the ophthalmological department of medicine. This remark especially refers to those works which have been issued since the introduction of the ophthalmoscope and the appearance of the classical works of Donders on Refraction and Accommodation, although we ought to bear in mind that Guthrie, Ware, Mackenzie and Lawrence wrote works on the eye in the earlier part of the 19th century, which are still referred to with interest and profit by the modern ophthalmologist.

The thorough training of medical students in the future seems now to be assured and the course in ophthalmology as now offered in Denver will go far to increase the number of well trained ophthalmologists. We heartily express the hope that it may not only prove eminently successful in advancing the interests of the science, but also eventually lead to similar courses being introduced in all the great medical centres of the United States.

Eye work seems to have a peculiar fascination for the younger men of the profession and as Ophthalmology becomes more recognized as a specialty, it is to be feared that many in the future, as in the past, will be tempted to launch out into the practice of Ophthalmology before they have become proficient as general practitioners. It is becoming more and more evident that the diseases of the eye are distinctly related to the diseases of the whole system, and it is well that the young medical man should realize this fact, and not too hastily confine himself to the study and practice of a specialty before he is proficient in the practice of general medicine.

L. W. F.

Book Reviews

The Anatomy and Histology of the Human Eyeball in the Normal State—Its Development and Senescence, by Dr. Maximilian Salzmann. Translated by Dr. E. V. L. Brown, instructor in the Pathology of the Eye, the University of Chicago. The Chicago Medical Book Co., Chicago, Illinois. Price, $5.00.

The original and German edition of this book was reviewed in the July issue 1912 *Ophthalmology,* by Dr. Zimmermann. Its reception among the German readers of Europe and this country, has been favorable, so that without doubt this English translation, by Dr. E. V. L. Brown, of Chicago, will meet with much success in all English-speaking countries. The work has developed from Salzmann's lectures and is the back-ground for a safe foundation for the understanding of methods of clinical investigation and judging pathologic changes.

The descriptions are given from the point of view of the eye specialist and the work is not encumbered with full references to the literature, although some 244 works are given in the index as authorities. There are few illustrations in the text but the book is well illustrated by a series of nine photocollotype plates, each containing numerous figures which are well executed and which have mostly been made from the author's own preparations and specimens.

Dr. Brown has succeeded in making translation, giving as near as possible the thought of the author and likewise making most readable English.

The size of type and paper and the typography in general is first-class in every particular and the work is free from errors. Certainly this book should be taken, not only as a text book for advanced students, but also read by every ophthalmologist.

H. V. Würdemann.

Vol. III. Practical Medicine Series, Eye, Ear, Nose, Throat. Wood, Andrews, Head. "The Practical Medicine Series," comprising ten volumes on the year's progress in medicine and surgery. Under the general editorial charge of Gustavus P. Head, M. D., Charles L. Mix, A. M., M. D. Vol. III, **The Eye, Ear, Nose and Throat,** edited by Casey A. Wood, C. M., M. D., C. L., Albert H. Andrews, M. D., Gustavus P. Head, M. D. Series 1912, The Year Book Publishers, 180 Dearborn St., Chicago, Ill. Price, $1.25 single copy; $10.00 for 10 volumes.

This series is published for general practitioners, the arrangement in several volumes enabling those interested in special subjects to buy only the parts they desire. The articles selected for abstract and review, in these volumes, comprise by no means a large portion of the subject but the authors have selected those

which are mostly under present discussion and which deal with the advances made during the year.

It is again extremely gratifying to the reviewer to have the Editor on Ophthalmic subjects refer with thanks to the essays and abstracts in *Ophthalmology.*

The book starts out with the copy of an editorial by the Editor of *Ophthalmology* and the Editor of *Ophthalmic Literature* upon criticism of the number of reading men among the specialists and the want of support given ophthalmic journals. Then, under a well arranged series of captions, the literature of the eye is taken up by Casey A. Wood. That of the ear is abstracted and commented upon by Albert H. Andrews and the nose and throat by Gustavus P. Head; the whole comprising a volume of 358 pages with a satisfactory index of subjects and authors.

H. V. Würdemann.

Practical Exercises in Physiologic Optics—Burch, George J. The Clarendon Press, Oxford, England. Crown 800, pp., 164. Price 4 shillings ($1.35).

The origin and purpose of this book are sufficiently indicated by the following extract from the preface:

"This book was written for the practical classes in Physiological Optics required by the regulations for the Diploma in Ophthalmology of the University of Oxford. I have conducted such classes for the last two years in the Physiological Laboratory, Oxford, for Professor Gotch. Hence the occasionally minute instructions with regard to particular instruments. But for the most part the descriptions are general, and it is hoped that the boy may be found useful in other laboratories."

The methods of Section 1 for determining the constants of a lens are suitable in their simplest form for quite elementary classes, but the author shows how to apply them also to cylindrical and toric lenses. No dark room or optical bench is required, and the necessary requirements can be extemporized in a few minutes, thus rendering the Ophthalmologist independent of his laboratory.

Section II deals with the Dioptrics of the Eye, and involves the study of the Ophthalmoscope in its various forms. It comprises also a method of measuring acuity of vision.

Section III on the Judgments, and Section IV on the Sensations of the Eye, belong more to the physiological side of the subject. They include a number of typical experiments necessary to the proper comprehension of the phenomena of vision.

Section V covers the whole subject of Color-Blindness, and in particular contains full directions for applying the author's spectroscopic method of measuring the color sensations.

Section VI is devoted to the phenomena of flashing light, most of which, but not all, can be shown with advantage as lecture experiments.

H. V. WÜRDEMANN.

The Eye and the Glasses—von Rohr, M. Das Auge und die Brille. Aus Natur und Geisteswelt, Sammlung wissenfchaftlich-gemein-verständlicher Darstellungen. Verlag von B. G. Teubner in Leipzig, 1912. Price, 1.25 M. (30 cents).

This little book of 100 pages explains in clear language and in a popular style the optical qualities and effects of lenses upon the correction of optical defects. It likewise goes into the mathematics, at the same time describing the various forms of lenses, kinds and fittings of eye glasses and spectacles and even such optical aids as field and opera glasses and lorgnettes.

H. V. WÜRDEMANN.

NOTICE

Owning to the absence of a number of our staff abroad, the abstracts of current literature have been omitted from this edition and a much larger number than usual of original articles have been accepted and are printed herein. The January issue will, therefore, contain the abstracts for the previous six months, together with original articles.

The EDITOR

In order further to popularize the demand for BACTERINS — (Bacterial Vaccines), and enable physicians to make more general use of these products, we call attention to the downward revision of prices on Mulford Bacterins, effective August 5th.

The Mulford Bacterins are in every case "polyvalent," which means that the bacteria contained in a Bacterin, although of the same species, are obtained from many different sources. For instane, Strepto-Bacterin is polyvalent, the bacteria used for its preparation are all streptococci and are isolated from different patients suffering with streptococcic infections among which may be mentioned puerperal sepsis, general septicemia, erysipelas, tonsillitis, empyema, cellulitis, etc.

A number of the Mulford Bacterins are "mixed," by which is meant that they contain the various bacterial species generally present in a mixed infection. For instance, the mixed Vaccine of chronic gonorrheal infections, besides the gonococcus contains various staphylocci, colon bacilli, streptocci, and other organisms isolated from cases of chronic urethritis and prostatitis.

In some cases diseases from their inception are due to mixed infections, while in many others the infection becomse a mixed one as the disease develops. Past experience and results have fully established the advantages claimed for these "polyvalent" and "mixed Bacterins."

SOME VALUABLE PRODUCTS FOR THE TREATMENT OF DISEASES OF BACTERIAL ORIGIN.

Since the advent of diphtheria antitoxin it is doubtful if any new remedial agent has elicited greater interest than is now being manifested in the bacterial derivatives known as Phylacogens. These products were originated by Dr. A. F.

Schafer, of California, the method of preparation and technique of application being first presented to the San Joaquin Medical Society in Fresno. To the uninitiated it may be said that the term Phylacogen (pronounced phy-LAC-o-gen) means "phylaxin producer," being derived from two Greek words signifying "a guard" and "to produce." The Phylacogens are sterile aqueous solutions of metabolic substances generated by bacteria grown in artificial media. They are produced from a large variety of pathogenic bacteria, such as the several staphylococci, streptococcus pyogenes, bacillus pyocyaneus, diplococcus pneumoniae, bacillus typhosus, bacillus coli communis, streptococcus rheumaticus, streptococcus erysipelatis, etc.

Four Phylacogens are now offered to the medical profession: Mixed Infection Phylacogen (used in the treatment of bacterial diseases of unknown etiology), Rheumatism Phylacogen, Erysipelas Phylacogen, and Gonorrhea Phylacogen. They have been thoroughly tested clinically and are said to be producing excellent results in the treatment of the various pathological conditions in which they are indicated. They are administered hypodermically—subcutaneously or intravenously—preferably by the former method, the latter being advised only in cases in which a quick result is demanded. They are supplied in hermetically sealed glass vials of 10 Cc. capacity.

The Phylacogens are prepared and marketed by Parke, Davis & Co., who have recently issued a 24-page pamphlet which describes them in detail—the process of manufacture, therapeutic indications, dosage, methods of administration—everything, in fact, that needs to be known by the man who desires to use Phylacogens. Every physician in general practise, every practitioner who desires to keep abreast of the latest advances in bacterial therapy, should have a copy of this valuable booklet. Write to Parke, Davis & Co., at their general offices in Detroit, Mich., ask for the "Phylacogen pamphlet," and mention this journal.

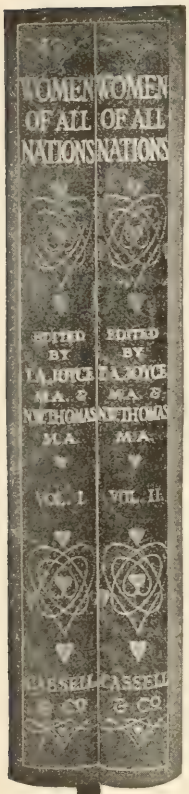
Women of All Nations

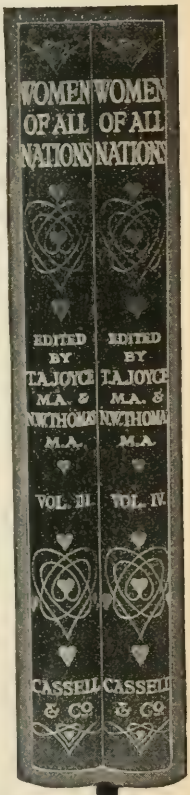
Their Characteristics, Customs, Manners, Influence

Edited by T. Athol Joyce, M. A., and N. W. Thomas, M. A., Fellows of Royal Anthropological Institute

Contributors: Prof. Otis T. Mason, Smithsonian Institution; Mr. W. W. Skeat; Mr. Archibald Colquhoun; Dr. Theodore Koch Grunberg, Berlin Museum; Miss A. Werner, Mr. W. Crook, etc., etc.

Most readers of the "National Geographic Magazine" have read about or already possess this splendid work. The allotment for America is gradually being sold, and this may be the last announcement before the work goes out of print. Prompt action is therefore urged upon members who are interested.





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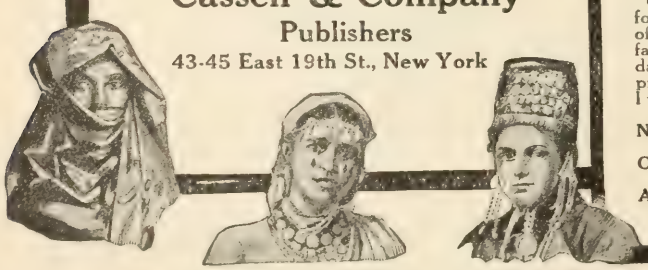

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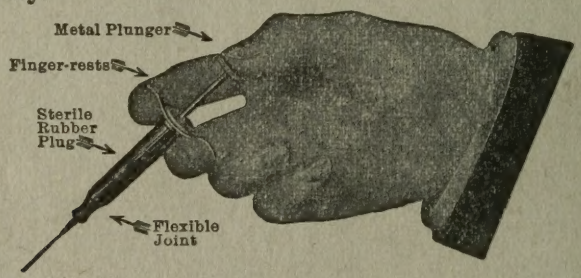

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